THE SHOP TEACHERS' PROFESSIONAL MAGAZINE

Industrial Arts and VOCATIONAL EDUCATION

SEPTEMBER, 1942 VOL. 31, No. 7

HE TIED PAPER BA... ON CORN SILKS AND TASSELS

—Educators know what it means

BACK in the 1920's, Lester Pfister was a not too prosperous farmer living near El Paso, Illinois. He was not too poor to dream, however, and he dreamed of a more perfect, more productive corn. Then an idea came to him . . . and he spent his next ten summers out in the blazing sun tying paper bags on corn tassels and silks, making thousands of hand pollinations. By careful selection, weaklings among the corn plants were eliminated. His neighbors laughed at his crazy experiments, and by 1935 he was virtually penniless. All he had to show for his efforts were four gnarled, runty nubbins. But these ears had within them, he knew, the parenthood of such corn as was never seen before. Indeed, in the eight years following, other farmers planted more than 15 million acres of corn from hybrid seed produced from those four ears. Today, Pfister's Hybrid is known to farmers in every state of the union.

Just as Lester Pfister carefully nurtured his strain of corn through the years and shielded it from deterioration, so the true educator who works beyond the day's lesson toward the betterment of the human race, seeks to nurture the minds of the boys in his class, to surround them with influences of a constructive and inspiring nature. From these lads must come the leadership of this country tomorrow, in their minds may be the parenthood of a world far better than any we have ever known. In minds so nurtured, the ideas that can mobilize all an individual's energy behind them far more easily take root. In minds so nurtured, the spark of achievement possessed by *all* is more easily fanned into flame.

Instructors in mechanical drawing know the influence that can be exerted on youthful minds and imaginations by the drawing instruments these boys use. Usually a lad's drawing set is his introduction to the world of craftsmanship, of precision work, of disciplined thought and controlled activity. First impressions here are unusually important. Caught at the flood tide of his interest, a fine drawing set can lead a boy's imagination to the great engineers and scientists and their achievements, which in turn lends new dignity and respect to the work he is doing. Familiarity with fine tools of precision and craftsmanship gives the lad a foretaste of the fruits of achievements, lift his standards, sharpen the distinction between good work and shoddy. Too vital to be regarded casually at *any* time, a student's drawing set should be selected with the utmost care. Here is one time in a student's life when wisdom counsels *the best the student can afford.*

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INDUSTRIAL ARTS *and* VOCATIONAL EDUCATION

VOL. 31 SEPTEMBER, 1942 Number 7

IN THIS ISSUE

The contents of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION for September has been specially chosen to be of assistance to the shop teacher at the moment when he starts out his first class in the new school year.

Probably first mention should be made of the article paying tribute to the late Charles A. Bennett, whose death on June 17, 1942, ended a truly noteworthy career. His demise robbed the teachers of industrial arts and vocational education of a great leader.

The needs of the times make the following articles of general interest: "The United States Marine Corps and Vocational Education"; "Preselection and Classification of Defense Trainees"; "Preinduction Training Needs on the College Level for Enlisted Men in the Armed Forces"; and "Record Forms for War Production Training Classes."

Likewise, teachers of war production training classes may find the "Shaper Vise" on page 293, the "Reducing Sleeves — Operation Drawing" on page 299, "Cemented Carbide Tools in a School Machine Shop" on page 305, and "Grinding Wheel Safety" on page 317, very helpful.

Shop teachers in general will be delighted to hear that Burl N. Osburn will favor the magazine with a series of plates on design. The first three of this series will be found on pages 314, 315, and 316.

Besides the articles already mentioned, there are others which will be found not only appropriate for this issue, but of great help throughout the year.

THIS MONTH'S ISSUE

The three young men pictured on the cover are among the many who are being trained as aviation machinists for duty in the United States Marine Corps. They are shown assembling an airplane propeller.

The photograph for the cover and others used in the article on "The United States Marine Corps and Vocational Education," by Staff Sergeant Thomas A. Fischer, were all used with the permission of the United States Marine Corps.

BUY U. S. BONDS AND STAMPS

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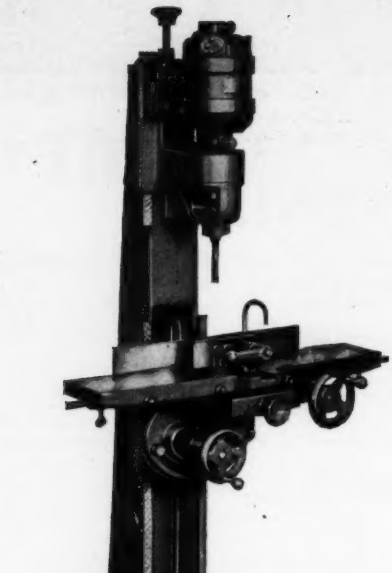


J-40 MORTISER

VITALLY essential to the war effort is the instruction in woodworking that vocational trainees are receiving on Yates-American machines. With wood being used more and more each day to replace scarce materials, this training is becoming increasingly important.

In almost every vocational training center you will find Yates-American machines because experience has shown that they are the most practical and best suited for this type of work. Recognizing the fact that these machines are to be used by inexperienced operators, every precaution is taken to make them safe. All moving parts are enclosed . . . safety devices are built in as an integral part of the machine . . . unlimited effort is made to eliminate mechanical failure.

Yates-American industrial-type machines for school use are full sized and substantially built. They will stand up under prolonged, hard usage. Extended schedules of day and night classes will not tax their endurance or capacity. They are long-lived and cost little to maintain.

The J-40 Mortiser shown here is one of the members of the well-known Yates-American "J-Line" which is being used extensively in schools for both fundamental as well as advanced instruction in woodworking.

YATES-AMERICAN MACHINE COMPANY • BELOIT, WISCONSIN

Short Talks on Wood

TEAK (*Tectona grandis*)

Noted for its extraordinary durability. Teak beams have been known to last for more than 1000 years. Considered the most important ship-building timber in the world. The wood is moderately hard, strong, straight-grained and easily worked. Oily and fragrant. Heartwood has a beautiful golden-yellow color which darkens with age.

Is used for decks, rails and deckhouses on ships. It is thought that the oil which it contains preserves iron, and for that reason is used to back up armor plate on war vessels. In Europe it is highly prized for furniture and interior finish.

A native of Burma, India, Thailand (Siam) and Java. Most of the exported lumber comes from Burma. It grows on a great variety of soils, but absolutely demands perfect drainage or a dry subsoil.

A large tree with a tall, straight trunk and a spreading crown. May attain a diameter of 2 to 3 feet and a height of 100 to 150 feet. Grows rapidly when young.

The bark is gray or brownish gray, about a half inch thick. The leaves are opposite, from 1 to 2 feet long and from 6 to 12 inches wide. In shape they resemble tobacco leaves but their substance is so hard and rough that the natives often use them for sandpaper. The tree is leafless during the dry season but fresh foliage appears with the arrival of the first monsoon rains. Bears small, white flowers.

To date, thirty-seven brief articles similar to the one above and dealing with the more commonly used woods have appeared in these ads. As in the past, we continue to invite your suggestions as to the species of wood you would like featured in this series.

YATES-AMERICAN

INDUSTRIAL ARTS *and* VOCATIONAL EDUCATION

The United States Marine Corps and Vocational Education

STAFF SERGEANT THOMAS A. FISCHER*

Industry has benefited and is sure to benefit more, when final victory is won, from the trades which are being taught to hundreds of marines at 37 vocational trades schools maintained by the United States Marine Corps at its various bases.

When modern warfare became more and more mechanized, highly specialized workers were needed in the various branches of the corps in order that this oldest branch of the fighting services could maintain the high degree of efficiency it has attained in its 167 years of military history. For this reason, schools teaching various mechanical trades were established by far-seeing officers of the corps.

Each man must be sufficiently schooled in his particular trade so that under the most trying conditions he can quickly make or repair any vital part needed to keep the fighting units of Uncle Sam's leathernecks at their peak.

*U. S. Marine Corps, Chicago, Ill.

Members of the vocational classes are picked men. When a Marine recruit arrives at a training base, he is interviewed as to his civil life, his work and his hobby. He is also given tests to ascertain his rightful place in the corps. From the interview and the tests, the marine after training, is sent to where it is believed he is best fitted. The desires of the man as to the work he wishes to do in the corps are also taken into consideration before a decision is made.

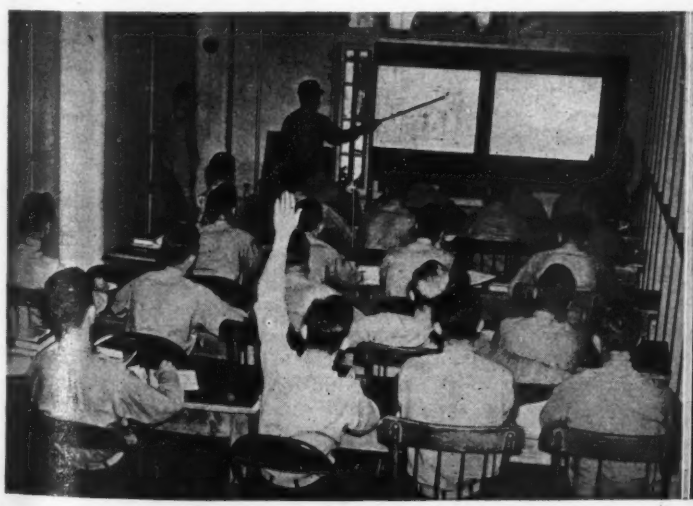
The course of instruction which each marine undergoes at the trade schools is a vigorous one, more so now with the increased tempo of the war with the Axis. Weeks and sometimes many months are spent by each man learning the use of the most intricate tools of his trade under the guidance of expert marine or civilian instructors.

At various times during the schooling, each man is given tests. If his grade does not come up to the high standards set by the corps, he is given additional instruction in order to help him, or he might be transferred to another line of duty with the marines.

Marine adroitness as masters of their art was demonstrated by the leatherneck mechanics during the historic defense of Wake Island. Overnight aircraft motors and parts were transferred from one plane to another so that up to the final day of the 14-day battle, marine planes were always in the air.

Commenting about the situation on the island, Major Paul A. Putnam, who was in charge of the marine aviators at Wake, said in one of his reports, "Parts and assemblies have been traded from plane to plane, have been junked, stripped, rebuilt, and all but created." This was an officer's tribute to the men who helped to "Keep 'em flying."

The various aviation trades — machinist,



At the left, a wire-communications class at a marine corps school

At the right, an instructor explaining the calibration of a rifle's sight to a leatherneck student at armorers school

At the left is shown a young marine getting his field experience with a portable switchboard

At the right, field telephonists climb a pole to string wire during a session in the field

metalsmith, mechanic, ordnance, and others — are not the only vocational trades which the marines have an opportunity to learn. All forms of radio, electrical, telephone and telegraph, armorer, photography, and many other trades are in the curriculum of the marine corps schools.

If the young marine is interested in radio, he might request transfer to the radio operators school for instruction. Radio sending and receiving, typing, elementary radio theory, elementary electricity, naval radio procedure, and field radio sets would be taught him before graduation.

Or if he were interested in another branch of radio, he might attend the radio material school, where grouped under the four major courses of electricity, radio, transmitters and receivers, he would study the following subjects: Mathematics, mechanics, direct current, power supplies, keying circuits, rectifiers, transformers, motor generators, oscillators, power amplifiers, and electrodynamics.

Communications is another phase of radio where the young marine might learn a trade. At a signal school, the leatherneck would study code practice, installation and adjustment, electricity and magnetism, radio net operation, shop maintenance, and other relative subjects.

All phases of telephonic subjects are taught marines at the various schools. The marine can attend telephone electricians school where he would learn direct current, alternating current, mathematics, local battery telephony, common battery telephony, telephone power plants, substation installments, map reading, telephone central office practice and testing methods.

As telephone electricians, the leathernecks would also get a knowledge of cable splicing, field wire equipment, and pole line construction.

For those who are interested in field work, the marines' field telephone school teaches elementary electricity and magnetism, local battery telephone, field switchboards, field telephone equipment, map reading and all techniques of field wire systems.

With the troops all moving on wheels, motor transport and its work of maintenance and operation proves a fine career for the interested young man. The marine is taught the practical and theoretical work in driving, engine repair, chassis repair, ignition, and carburetion. The leatherneck who is ambitious and works hard in his classes is given an advanced course of six months in motor transport which further enables him to fully equip himself with the knowledge and experience that will make him useful to the marine corps in dealing with its problems of motor transportation.

Many other courses are open to marines who "Earn while they learn." The armorers school gives a thorough training in the mechanics of weapons and practical training in the repair of infantry arms.

Fire control school gives special instruction in electricity for antiaircraft control.

Engineer school covers three main courses of surveying, drafting, and aerial photographic mapping.

Aerographers school instructs marines in weather codes, meteorological instruments, clouds, synoptic weather-chart work and many relative subjects.

Versatility, as many people know, is a characteristic of the marines. The leatherneck may learn how to repair aircraft motors and he may practice that trade while in the corps, but the marine must always remember his rifle and keep the knowledge of his weapons because at any time he may be called upon to take his place, side by side, with his comrades in the front lines. He never forgets that he is first, last, and always a fighting man — a United States marine.

DRIVE ECONOMICALLY

If every driver would cut the average cruising speed of his car just 10 miles per hour, a material saving in gas would result and driving would be much safer.

If we want to convince ourselves that we should adopt sensible driving practices, let's look at facts from studies made at Iowa State College in cooperation with the U. S. Public Roads Administration.

The studies included 260,000 miles of driving over two test routes on Iowa highways; each route was approximately 235 miles long. One highway was gravel, the other concrete. The studies showed definitely that a lot of gas and oil can be conserved by more moderate speeds on highways. Since air resistance builds up at an enormous rate at higher speeds, it's just common sense that gasoline and oil requirements would be greater. The test proved that at 65 miles per hour — as compared with 40 miles per hour — gas consumption was more than 30 per cent higher. Yet the average gain in speed was only 15 miles an hour, and as the faster driver had to slow down more frequently and with greater abruptness, the number of brake applications and braking time were increased 50 per cent at 65 miles per hour as compared with 40 miles per hour.

The most important single cause of auto accidents is speed too fast for conditions, and speed at intersections.

— *Milwaukee Safetygram*

Preselection and Classification of Defense Trainees*

LAURENCE W. ROSS**

It became evident in the spring of 1941 that in some sections of the country, and notably in South Carolina, improved methods would have to be devised for the selection of enrollees for defense classes. Patently it would be impossible to accept all applicants for enrollment; not only would the effort to train relatively unemployable men be futile, but also the exigencies of the situation demanded that of the applicants the most fit were needed by industry. Since other agencies had not assumed responsibility for selection of prospective enrollees, it developed upon the defense training supervisors to attend to this need.

The problem before the directors of the defense training program therefore appeared twofold: (1) to select the most employable and trainable candidates for enrollment in defense classes; (2) to assign those selected to the classes for which they appeared most suitable, both from the standpoint of learning and from the standpoint of interest. In order to establish a method of selection and classification it was decided, through the cooperation of the South Carolina State Department of Education, to set up in the Greenville area an experimental program for the summer classes. To these classes interviews and standardized tests were to be applied, the tests to aid strictly in determining methods of selection and classification, and the interviews to get an accompanying background of the trainee's interests, as well as data for placement and follow-up purposes.

The Greenville Defense Training Program

The school districts comprising the Greenville community, the Greenville City schools, and the Parker schools, were chosen for purposes of the interview and testing experiment. Each school district had classes in different shop subjects: machine-tool operation and welding in the shops of one school district, and auto mechanics, electrical maintenance, and machine molding in the other. Negroes were enrolled only in the auto mechanics, where two shop buildings were available, and the machine-molding shop was operated in a cooperating industrial establishment being set up to do defense work, and which planned to absorb a portion of the trainees who completed the course successfully.

One interviewer was employed, and he, with the occasional assistance of two helpers, held personal interviews with each enrollee, applying individual tests of mechanical aptitude at the same interview. Group tests were arranged for as occasions permitted. All in all, about 45 minutes to an hour was given over to interviewing and testing each trainee or applicant, exclusive of the time required for the individual's participation in two or more of the group tests.

In all instances the cooperation of the directors, the instructors, and the trainees was of the highest order. This was no accident, as the directors took pains to explain the nature of the experimental work to both instructors and trainees. Further than this, in all instances the interview for obtaining personal data for placement records preceded the testing, and consequently the interviewer had opportunity to get "en rapport" with each client.

In most instances the interviewing and testing were carried on in the vicinity of the shops themselves, in order not to create an unnatural situation for the trainees, who were usually grimy and fresh from the machines. In the case of applicants for one shop that was set up after the interviewing had begun, all applicants reported to a school office, since these applicants were not necessarily in "working" clothes and had not been called from machinery for the interview. However, extreme care was taken in all instances to ensure that the standards for proper application of tests were met.

The Interview

As recommended by the state department of education, and developed from a form sent out by the Federal Security Agency offices, the following outline of information regarding each applicant was secured, with test data added at the end of the sheet:

Name.....

PHYSICAL AND HEALTH RECORD

Height..... Weight.....

Days sick during past year.....

Type of illness.....

Date last consulted a doctor.....

For what reason?.....

List physical handicaps:

INTERESTS AND APTITUDES

Grade completed in school.....

Put a check mark in the proper column at the right showing how well the candidate liked each of the following kinds of schoolwork.

	Much	*Little*	*Disliked*
Mathematics	.....	.....	.....
Science	.....	.....	.....
Shopwork	.....	.....	.....
Agriculture	.....	.....	.....
Language (grammar and spelling)	.....	.....	.....
Commercial	.....	.....	.....
History and Geography	.....	.....	.....
Other Subjects.....	.....	.....	.....

List also the following: Kinds of magazines and books you like; hobbies and leisure activities; part-time work you have done in past; things you have repaired with tools; hand tools you use skillfully; kinds of machines you know how to run; measuring in-

Applying the Minnesota spacial relations test

*More recent data supports the tentative conclusions based on the small numbers reported upon in this article.

**High School, Greenville, S. Dak.

struments you have used; tell of any work you have done from blueprints, floor plans, or other scale drawings.

TEST RECORD

Minnesota Paper Form Board, Minnesota Spatial Relations, O'Connor Finger Dexterity, Army Alpha (Wells), Army Beta, Other types.

In order to put the trainee at ease, quite naturally the interviewer did not rush the interview. Rather, the conversation was carried out without haste, and interspersed with other questions and answers not necessarily relevant to the data sheet. In this manner good rapport was established for the tests to follow.

The tests employed were as follows:

Minnesota Test of Spatial Relations (Boards *A* and *B*, or *C* and *D:* time was not available for applying all four boards to each client.)

O'Connor Finger Dexterity Test, Minnesota Paper Form Board (Revised by Likert and Quasha); *O'Rourke Mechanical Aptitude Test,* Junior Grade, *Army Alpha* (Wells Revision), *Army Beta* (Kellogg and Morton Revision).

Description of the Tests

The Minnesota Spatial Relations test is composed of a set of four standard formboards (*A, B, C, D*), in each of which are spaces for the placing of appropriately fitting pieces. This test is supposed to measure both speed and accuracy in the discrimination of size and shape, though other factors are observable. Because of pressure of time it was impossible to test all Greenville clients with all four boards; either boards *A* and *B* or boards *C* and *D* were used as a pair, as norms were available for either combination, as well as for the entire set. It is true that the use of two boards alone is not justifiable for ordinary individual diagnosis, but as part of a larger battery it seemed justifiable in this instance if only for the attendant situation that provided standard conditions for observations of personality traits. Accordingly, where unusual personality traits were displayed, a notation was made by the interviewer as part of the individual's record on this test.

The Finger Dexterity test (Johnson O'Connor's work sample No. 16) is useful as an indicator of aptitude in work involving rapid manipulation of small objects. This ability seems to be useful in those kinds of benchwork involving placement of small parts, as in clock or watch manufacture and similar assembly work. The client in this test is asked to place as rapidly as possible three uniform brass pins in each of 100 uniformly spaced holes in the work board. Women engaged in meter and instrument assembly, and bank tellers make above average scores on this test.

The Minnesota Paper Form-Board, revised by Likert and Quasha, is a pencil-and-paper type test composed of 64 problems of matching shape and size in geometrical figures. As far as paper-and-pencil tests go in the measurement of mechanical aptitude, this test is quite valid.

The L. J. O'Rourke Mechanical Aptitude test, Junior Grade, is another paper-and-pencil test, but of the information variety. Part I is pictorial, involving the matching of pictures, paired according to their use. The problem is to show which tool in a group of pictures is used with certain pictured objects. Part II is a multiple-choice examination of mechanical information. Strictly speaking the test is a test of mechanical information, rather than of mechanical aptitude, but it seems to be true that a person who has some mechanical aptitude will naturally gravitate toward opportunities to work with tools, whereas one without the requisite aptitude has tended to ignore the same opportunities. In any event the individual test score must be interpreted only in the light of previous opportunities for getting acquainted with tools and machinery.

The Army Alpha test, Wells Revision, is an improvement, as far as use in schools and industry is concerned, over the original Army Alpha. At the same time, it has preserved the very valuable norms based upon large samples of adult men, and the occupational data. It was thought advisable to include an intelligence test in the battery to be applied to trainees in Greenville, since it would be expected to serve not only for prediction but also as an indicator of the general occupational level for which a person might be able to prepare and to work congenially.

The Army Beta test (Kellogg and Morton Revision) is a nonlanguage group intelligence examination, used with several of the Greenville classes whose level of schooling was low. It was observed by the interviewer that in a number of instances, the numbers of school grades completed by trainees were not comparable, since small rural school grades may have been in session for perhaps only four or five months in an entire year. When a client responded that he had "completed six grades" in such a school, it was nevertheless apparent that his reading ability and comprehension were not up to the level one would expect. To have applied the Army Alpha in groups containing such cases would have been manifestly unfair.

In addition to the foregoing tests, a few people were given the O'Connor tweezer dexterity test, but few displayed any of the particular co-ordination and dexterity measured by this test. For most of the training courses offered in Greenville this test appeared to be relatively useless.

Some Results of the Interviews

Unfortunately, owing to the continual shifting of men from training to the actual job, and because of elimination and drop-outs, it was found impossible to give everybody every test. This was because it was impossible to give each man all the tests at one interview. If, for example, a machine-tool trainee was interviewed, and the finger dexterity test and spatial relations applied at this interview, it was possible for him to have been placed in a job, most likely out of town, before his total group could be called together for the O'Rourke test, or mental ability test. Other causes for this lack of uniformity in all cases were (1) the discontinuance of some of the NYA sponsored group, owing to the discontinuance of that work camp, (2) failure of delivery of some tests in time, (3) the fact that only one interviewer could be provided, and (4) "laying off" of some WPA trainees.

However, it was possible to apply to each of 73 persons in the Greenville program all of the following: a mental test (either Alpha or Beta), the O'Rourke, the Minnesota spatial relations, and the finger dexterity test. A table of intercorrelations based upon this number will therefore be presented later in this report.

Results of the Testing Program

In an effort to discover whether there might be a pronounced relationship between scores of any of the tests and performance in training classes, scatter diagrams were plotted for each of the tests in relation to tentative marks assigned at about two-thirds way through the course. This was done for the welders and machine-tool workers, for whom marks were available at that point in the course. Tables 1 and 2 display two scatter diagrams to illustrate just how critical scores or score areas were arrived at.

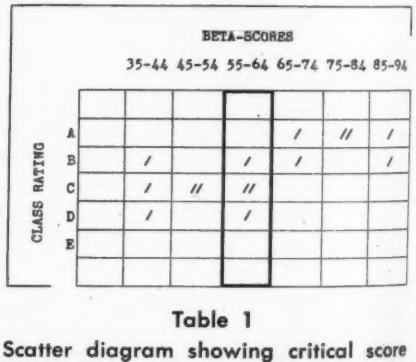


Table 1

Scatter diagram showing critical score area below which candidates for welding course may be eliminated

The relationships were sought between the following variables:

Welders

Marks and beta test, marks and spatial relations (time), marks and finger dexterity, marks and O'Rourke test of mechanical aptitude, marks and alpha test, marks and number of years of schooling.

Machine-Tool Trainees

Marks and alpha test, marks and spatial relations (time), marks and spatial relations (error), marks and finger dexterity, marks and O'Rourke.

Tables I and II show scatter diagrams showing the results obtained from these tests.

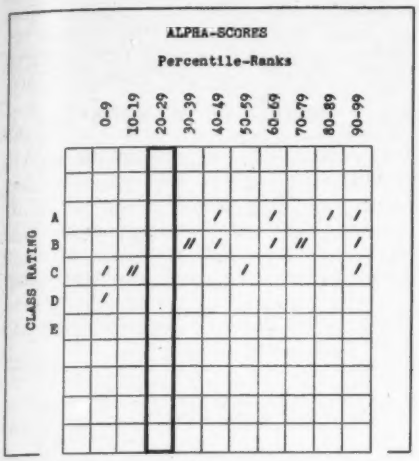


Table 2

Scatter diagram showing critical score area below which candidates for machine-tool courses may be eliminated

Machine-Molders

Class rank and alpha test, class rank and finger dexterity, class rank and tweezer dexterity, class rank and spatial relations.

Electrical Maintenance and Repair Trainees

Class rank and alpha test, class rank and finger dexterity, class rank and spatial relations, class rank and O'Rourke test of mechanical aptitude.

Auto Mechanics

Class rank and beta test, class rank and spatial relations, class rank and finger dexterity, class rank and O'Rourke test of mechanical aptitude.

Critical Scores for Welders

In the scatter plot representing the relationship between proficiency marks in welding and performance upon the beta test, there is a definite line of demarcation separating successful and less successful trainees in welding. The two *D* trainees, whom the test would be expected to select from more competent candidates, are clearly separated at the interval from scores 55 to 64. Furthermore, the test appears to discriminate equally well for the *C* students, whom it would be desirable to eliminate from the course if applications warranted a finer discrimination. The fact that two *B* students would be lost by this discrimination is not of great importance considering the preponent possible "dead" weight to the class represented by seven relatively unsuccessful trainees. If further investigation in the added numbers serves to verify the critical score area of the beta test at from 55–64 the usefulness of the test would be quite apparent, at least for trainees in welding classes.

In the case of the spatial relations test (time) there is no such marked point of discrimination between unsuccessful and successful *B* and *A* trainees. The *most* competent welders are apparently selected, but almost as many *B* and *D* trainees would have to be rejected if a critical score were set at the interval of 40th percentile rank on the spatial relations test to say nothing of the two *D* trainees who would be retained.

The finger dexterity test does seem to discriminate the *A* trainees, but not quite all the *D's*. Furthermore, if a critical score were set at the 30th percentile, three trainees of *B* caliber would be rejected, though this is not quite as important as the first matter. Similarly, the O'Rourke test bears some discriminating tendencies. A larger number of trainees should be observed before reaching any conclusion about ultimate possibilities in the use of these two tests.

The alpha test does not discriminate as well as does the beta, since a critical score at the interval 66–80 would not reject one of the highest scoring trainees on this test. While a rough relationship between marks and years of schooling is observable, there is no promise of discrimination between successful and unsuccessful trainees upon this basis.

Applying the finger dexterity test

Critical Scores for Machine-Tool Workers

The alpha test seems to bear possibilities as an instrument discriminating between successful and unsuccessful machine-tool trainees, since the lone *D* and three of the five *C* trainees fell below the critical area of the 20–29th percentile rank. It was unfortunate that time did not allow for the application of the beta test to this group; however, this was a more carefully selected group, and the level of literacy warranted the initial administration of the alpha in preference to the beta as a measure of mental ability.

Similarly the time scores for the test of spatial relations appear to discriminate fairly well, at about the 30th percentile. More population is essential in order to judge this test, however. The error scores do not select either the poor or good trainees very well.

The finger dexterity test seems to have possibilities, but again more population is desirable.

The O'Rourke test seems to work better for the machine-tool workers than for the welders, since it definitely appears to select the *A* and *B* class of trainees, and rejects the lone *D* candidate.

Test Scores and Training in Machine-Molding

It was found to be impossible in the case of the earlier classes in machine molding, auto mechanics, and electrical maintenance and repair to develop critical score areas for any of the tests. This was because it was felt that the teachers in these classes were more able to rank their students or trainees than to give them marks as the other teachers were able to do; teachers for these courses were practical workers in their respective occupation, and were loath to try to give marks in the 5-point (*A, B, C, D, E*) scale as is so customary in ordinary school teaching. It was therefore found to be more suitable to rank the trainees according to their standing in their respective classes, and these rankings were used in working out correlations between class performance and test scores by the method of rank-differences. In this method (cf H. E. Garrett, *Statistics in Psychology and Education*, pp. 360–3) rho is computed as the rank-order coefficient of correlation, and it is then transmuted into product-moment-*r* by means of an inference table (cf Garrett, p. 362).

Candidates for classes in machine molding were given: the O'Connor finger dexterity test, the O'Connor tweezer dexterity test, the Army Alpha (Wells revision), the Minnesota spatial relations test.

Because of the extreme urgency in a local plant to fill defense orders, and also because training equipment was limited in this shop, some arbitrary selection had been practiced in this group of trainees in advance of the application of the bat-

tery. As might have been expected, correlations were affected by the nature of using a select group for the tests.

Practically no correlation was found to exist between class standing and performance on the finger dexterity test, the relationship being represented by $r = .05$.

Performance on the Minnesota spatial relations test seemed to exhibit more relationship with progress in the machine-molding class; the relationship here was $r = .25$, but with large probable error. Here again, it must be recalled that this group, on the whole, may be said to be fairly well selected.

Strangely enough in the case of the Army Alpha a negative relationship was found to exist. The coefficient here is $r = -.39$, and is high enough to be of some significance. It would not appear to be remarkable if the correlation between alpha performance and success in machine molding were around zero, as there is not necessarily any correlation between intelligence and the peculiar combinations of delicate touch and quality of patience so desirable in the specific tasks of this job. The fact that machine molding is a job done in dirt and perspiration and the fact that several of the trainees were intelligent to a high degree possibly combined to produce a situation where stolid patience led to extreme success at one end of the scale, whereas the high order of intelligence led to distaste and lack of success at the other end of the scale. The effect of these extremes would not be so apparent in a large enough sample of these trainees.

In the case of the machine molders the tweezer dexterity test appears to be the most useful of the tests, with a correlation coefficient of .52. If marks for the trainees were available on the 5-point scale it seems likely that this test might yield a useful critical score in the future. Since all the machine-molding trainees are being prepared for local industry it seems likely that more data regarding their ultimate success will be readily available as more of the trainees are prepared.

Test Scores and Training in Electrical Maintenance

To the trainees in electrical maintenance and repair four tests were applied: (1) the alpha (Wells), (2) finger dexterity, (3) spatial relations, and (4) the O'Rourke. Coefficients of correlation between test scores and later achievement in the classes proved to be relatively high in the case of this group.

As might ordinarily be expected, finger dexterity seemed to correlate very highly, .77, with success in the course. However, scores on the alpha correlated equally well, as the coefficient here was also .77. The O'Rourke also seems to have high predictive value here as its coefficient with class success is .69. Performance on the spatial relations yielded a coefficient of .50.

In view of the low educational level of this group it had originally been planned to apply the beta test rather than the alpha as a measure of intellectual capacity. Since the alpha appears to be promising with this group, on the basis of preliminary reasoning it seems advisable to try the beta as well, in the hope that it may prove even more useful than did the alpha.

Test Scores and Training in Auto Mechanics

Trainees in the auto-mechanics classes were given the same tests as were given to the welders: the beta, O'Rourke, finger dexterity, and spatial relations. There were two auto-mechanics classes participating in the program, one of white men, and the other of Negroes. The data for the Negroes are complete, but those of the white class are not very useful, owing to too frequent changes in the personnel, and more diversified offerings within the course for the white men.

Among the Negro auto mechanics three tests bear similarly high correlations. The spatial relations leads, $r = .71$. Next is the O'Rourke which correlates with class performance to a degree represented by $r = .69$. The beta test appears about as useful since $r = .65$ with class performance. Finger dexterity does not seem to figure very strongly among the predictive factors, since r is only .37 with success in the class. Success in the class was largely concerned with the acquisition of skill in doing motor repair work.

In the case of the white auto mechanics the results are inconclusive, for reasons suggested by the foregoing. It might be said that within the class there was a distinction between men who succeeded in body and fender work and those who did best at motor repair. Consequently when rankings are given in terms of general success at auto mechanics these rankings are difficult to make and produce inconclusive results in the correlations. Finger dexterity produced the negative correlation of $r = -.23$; the O'Rourke and spatial relations yield insignificant ratios of $r = .08$; the most significant was the beta, which yielded $r = .30$ with class success. More significant results must wait upon larger numbers in order that some distinction may be made between body repair and motor repair work in auto-mechanics classes.

Summary of Test Results

The relationships found to exist between success in various defense classes and scores attained upon standardized tests are summarized in terms of critical scores for machine-tool operators and for welders; the correlation between various tests and success in machine molding, electrical maintenance, and auto-mechanics classes are given as indication of the usefulness of the various tests for prediction of success in these classes.

1. *Machine-Tool Classes*

Test	*Critical Score Area*
Alpha	20–30 percentile rank
Spatial relations (time)	30–40 percentile rank
Spatial relations (errors)	No critical score
Finger dexterity	200–290 seconds
O'Rourke	175

2. *Welding Classes*

Test	*Critical Score Area*
Beta	55–65
Spatial relations (time)	30–40 percentile rank
Finger dexterity	30–40 percentile rank
O'Rourke	150–175
Alpha	65 (not very discriminating)

3. *Machine-Molding Classes*

Test	*Correlation With Class Rank*
Finger dexterity	$r = .05$
Spatial relations (time)	$r = .25$
Alpha	$r = .39$
Tweezer dexterity	$r = .52$

4. *Electrical Maintenance and Repair Classes*

Test	*Correlation With Class Rank*
Finger dexterity	$r = .77$
Alpha	$r = .77$
O'Rourke	$r = .69$
Spatial relations	$r = .50$

5. *Auto Mechanics* (Negro only)

Test	*Correlation With Class Rank*
Spatial relations	$r = .71$
O'Rourke	$r = .69$
Beta	$r = .65$
Finger dexterity	$r = .37$

6. *Auto Mechanics* (white only)

Test	*Correlation With Class Rank*
Beta	$r = .30$
Spatial relations	$r = .08$
O'Rourke	$r = .08$
Finger dexterity	$r = .23$

Intercorrelations Among the Tests

In the Greenville program all of the following tests were administered to each of 73 persons enrolling in defense classes: a mental test (either alpha or beta), the O'Rourke test of mechanical aptitude, the Minnesota spatial relations test, and the finger dexterity test. The resulting intercorrelations among these tests are displayed in Table III.

	O'Rourke	Finger Dexterity	Spatial Relations (Time)	Spatial Relations (Errors)
Intelligence Test (Alpha or Beta)	.79	.52	.69	--
O'Rourke		.41	.66	--
Finger Dexterity			.49	--
Spatial Relations (Time Scores)				.81

Table 3
Intercorrelations among the tests

In a few instances these correlations

were checked, using larger numbers for the data. For example, nearly twice this number took the spatial relations and the finger dexterity test, though all of these men had not had the O'Rourke. It was found that with the larger number the correlation between scores on these two tests was .48, only one point's difference from the figure found with the smaller number of subjects. While the alpha and the beta are by no means exactly equivalent, these also checked separately with only a point or two of difference resulting when compared with the figures shown in Table III. It is admitted, however, that the beta tests something besides ordinary verbal intelligence, perhaps something more nearly akin to mechanical aptitude.

The intercorrelations tend to show that there is little point in using the data for errors on the Minnesota spatial relations if the time scores are available. Similarly, there is possibly little point in using the O'Rourke and an intelligence test. Since the O'Rourke seems to bear lower correlation with class achievement, it may possibly be considered inferior to intelligence tests for our purposes. The finger dexterity test evidently measures something not included in the other tests, as evidenced by its low correlation with them.

Conclusions

Thus far in the testing program at Greenville the results can permit of only tentative conclusions. These may be summarized by giving in order for each type of training, what appears to be the best single test for prediction and classification in that group, and what would be a recommended battery, if more than one test is possible of provision.

1. In the *machine-tool* classes either the alpha or spatial relations may be considered a best test. Since they do not correlate too highly, a good battery might include both of these in addition to the finger dexterity. Since the beta has not been tried on machine-tool workers the conclusion as to the alpha is decidedly tentative.

2. Among *welders* the beta test appears most useful. The spatial relations and finger dexterity also add something and may well be included in a battery.

3. For *machine molders* the tweezer dexterity is the best test so far used.

4. For *electrical maintenance* classes the alpha and finger dexterity appear most useful; however, the beta has not been tried with this group yet.

5. With the *auto mechanics* the spatial relations test appears most useful, though the beta and O'Rourke add useful factors.

Further research is suggested in (1) the verification of these data by larger numbers of subjects, (2) more extensive trial of the beta test with all groups, and (3) the trial of other tests such as Bennett's test of mechanical comprehension, the Stenquist mechanical aptitude test, the Minnesota paper form-board. In the light of the needs indicated here it must again be emphasized that the present report is tentative. No excuse can be given for its presentation at this stage other than that present needs are urgent, and rough measures for classification are likely to prove more effective than none at all.

Preinduction Training Needs on the College Level for Enlisted Men In the Armed Forces*

ROBERT C. WOELLNER**

The American colleges and universities have contributed much toward the building up of the armed forces of our nation. Their graduates are looked upon as potential officer material. Their courses of instruction have prepared specialists for the many specific tasks involved in modern warfare. These institutions will continue to render this extremely important service, but they are now confronted by a new problem. A relatively high percentage of college men will be inducted into the armed forces as enlisted men rather than as officers. Many of them, even under an accelerated program in the colleges, will not be able to complete degree requirements prior to induction. Still others will volunteer. What can the colleges and universities do, what kinds of training should they give to equip most effectively these young men for their service in the armed forces and, at the same time, lay the foundation for their successful readjustment to civilian life?

In order to provide as comprehensive and as reliable guidance as possible to institutions of higher education, the American Council on Education has procured from the armed forces opinions concerning the kinds of training backgrounds which they deem worth while to the young men who join the services. With this in mind, the writer was invited to come to Washington to interview officers in charge of training in the various branches of the services. Answers to three questions were sought. (1) What are the training needs in enlisted personnel of the armed forces for which some college training may be beneficial? (2) What preinduction education would be beneficial to men entering the armed forces prior to completion of degree requirements? (3) To what extent are the armed services conducting their own training programs to meet these needs?

These questions imply an ambitious inquiry. This is especially true in the light of the limited time to be devoted to it. What makes it even more difficult is the fact that the characteristic tendency is to associate vocational requirements with high school or college graduation and not with intermediate levels, such as the one presented by our problem.

There are two generalizations to be drawn from the interviews with the officers, all of whom were responsible heads of the training programs for the various arms and services of the army, navy, and marine corps.

The first generalization is that a more definite and consistent program for physical fitness should be developed and required of all students. It is the first need mentioned here because it was almost always the first emphasized by those interviewed. Military men are definitely concerned with the evident lack of physical strength and general body care even among those who have the advantages of college training. These men, the potential leaders, as noncommissioned and commissioned officers, should be not only physically fit, but should also be thoroughly informed on matters of personal health and hygiene.

The second generalization to be drawn from the interviews is that the colleges should continue to provide the fundamentals of a liberal education for the intelligent and effective conduct of the individual in a wide variety of circum-

*This is one of three studies being conducted by the American Council on Education and the National Committee on Education and Defense under the general direction of Francis J. Brown. The others are: Bulletin 22, *Higher Education and National Defense*, prepared by the Committee on College Women and Defense of the National Committee; and *War Service Opportunities for College and University Students*, a series of statements prepared by M. M. Chambers and published periodically by the American Council.

**Executive Secretary, Board of Vocational Guidance and Placement, The University of Chicago, Chicago, Ill.

stances of modern mechanized warfare. The importance of this general education was stressed by every person who was interviewed.

The meaning of the term *general education* proved to be distinctly a personal matter, and one not readily defined. A summary of the viewpoints presented, however, emphasizes the point of view that the college should give the individual a basic educational background which will provide for essential knowledge, an understanding of fundamental processes, and an appreciation of basic values. It was generally believed by those interviewed that such a background of education provides the most effective basis for the individual's adjustment to the three requirements of military life. These are: (1) to execute and give commands (generally thought of as discipline): (2) to acquire skills and information for specific job assignments; and (3) to use his periods of recreation usefully and constructively.

Space does not allow for a discussion of the first. The second will be dealt with later. The third, although not discussed directly by many of the officers, deserves a place of equal emphasis to that of the other two which are more frequently commented upon.

How the soldier, sailor, or marine conducts himself during free periods — late afternoons, evenings, week ends — is a vital factor of general morale. It is a significant element in individual growth and adjustment. The measure of a man is his conduct when he is free to do as he pleases. What he does then depends upon his social and intellectual interests. These are developed by the individual in college. They are outgrowth of the programs in the humanities, the social studies, the natural sciences, and of planned leisure-time activities. These should be looked upon, therefore, as direct aids in meeting the exigencies of the current crisis. They will serve the individual also in the postwar period ahead of us. We have learned this lesson in peace, and it must not be lost in war.

The foregoing generalization concerning liberal-arts education was commented upon early in this report because the initial reaction to some information which will be given presently would seem to suggest a somewhat different conclusion. For instance, the replies to the question, "What are the training needs of the enlisted personnel in the armed forces?" provide a list of typical occupational classifications. This list might suggest a challenge to colleges to offer very specific and detailed programs of technical vocational training. So far as could be ascertained there was no disposition on the part of any of these officers to make trade schools of our colleges.

It was repeatedly pointed out, however, that if youth is given the proper educational background by the colleges, the armed forces could teach the specific techniques more effectively and in a shorter period of time than is required without such fundamental background. The need is for recruits, possessed of a broad background of training which will enable them to acquire later the skills essential to the manipulative techniques. The general training should be for as broad a variety of jobs as possible to be mastered in as short a period of time as possible.

The shortages of trained enlisted personnel most frequently commented upon by officers of the various armed forces are in the following fields: aerial photography; automobile maintenance; clerical; Diesel engine operation and maintenance; electricity; machinists (all grades); hydraulic specialization; laboratory technicians; languages; medical technicians (male nurses, both practical and operating room); radio maintenance; radio operation; sound technicians; surveyors; telephone maintenance; and X-ray technicians.

Two branches of the army stated that they have, as yet, experienced no shortages of trained workers. The chemical warfare corps reported that the general training in chemistry, given by the colleges has equipped a sufficient number of enlisted men for their required tasks.

The finance corps reported that at present there are only 14 of their men with each division in the field. That number can be supplied by qualified recruits.

The answer to the second question, "What preinduction education would be beneficial to men entering the armed forces prior to their completion of degree requirements?" reflected the needs of the specific arms and services. Colleges and universities dealing with the task of providing accelerated programs, both of general education and of elementary and basic backgrounds of training required of the man in military service, face, among other things, the problem of the determination of minimum essentials. These two emphases are not mutually exclusive; they are complimentary and in many respects identical, since for both it is basic knowledge and an understanding of principles that is emphasized rather than the development of a specific skill.

When confronted with the problem of providing background for later vocational training for the armed forces, there are two avenues of approach to its solution. The one is a series of job analyses; the other is a synthesis of personal judgments.

Job analyses could be made from the *training* and *field* manuals written by the armed forces. Many of these are distributed by the Superintendent of Documents, Washington, D. C. From these analyses could be drawn instructional units common to a number of jobs. This process has the advantage of definiteness of required background material. In order to determine specific course content for that part of higher education which is intended to provide background for later vocational training, analyses of the type suggested should be undertaken, as a joint enterprise between educators and the armed forces.

In lieu of the results of this type of thorough-going analysis the next best source of aid is the opinions of the officers in charge of training in the various branches of the services. Their opinions are most valuable. There was, as expected, a variation in their replies which reflected the major field of the particular arm of service. For example, the medical officers emphasized a background of training in the biological sciences; others stressed the physical sciences.

The specific studies which were mentioned as providing proper educational background which were reported again and again by the many officers in high positions, suggest nothing startlingly new to the college administrator. These officers were free to suggest unusual subjects such as ballistics, cryptology, and the like; yet they were seldom mentioned, and several discouraged the offering of such courses. Their statements of suggested educational background were carefully digested for this report, and their opinions should be given serious thought even though there seems to be only a new emphasis and not new subject-matter material in this list of studies. Two things should be kept in mind, however, to interpret properly the suggested studies of the officers. First, they had been asked to consider students who would be in college, short of graduation. Second, they naturally were thinking, in the main, of background material which would shorten, for the armed forces, the training period for specific jobs. They, therefore, strongly recommend the following studies:

Mathematics: Arithmetic, algebra, geometry, trigonometry, and some calculus, functions, graphs, and some surveying.

Physics: Standard course with special emphasis on the following: electricity and magnetism, hydraulics, mechanics, heat, light, sound, force and motion, optics, principles of internal combustion engine, telephone, telegraph and radio communication, Morse code and International code.

Chemistry: General course to include principles of explosives.

Physical Geography: Map interpretation, especially topographic maps and aerial photography, winds and weather.

Astronomy: As it relates to air and marine navigation, descriptive.

English: For concise oral and written expression.

Foreign Languages: Japanese (by non-Japanese), Russian, German.

Reading Blueprints and Making Isometric Sketches: Machine drawings (not necessarily the ability to draw), orthographic projection, isometric projection, conventional signs and military symbols.

Current World History: Current events and their interpretation.

Hygiene: Personal hygiene, first aid, field sanitation.

Physical Training: The final product to be not alone the skillful performance in games, but also the development of endurance — e.g., the ability to walk long distances and after reasonable rest to be able to repeat without experiencing sore muscles. To provide each student with experience in giving commands to groups. Execution of commands with precision requiring muscular co-ordination.

The report of such a program now conducted in the navy will soon be released through the Joint Army and Navy Committee on Welfare and Recreation, temporary Building G, Washington, D. C.

The officers who were interviewed realize that the typical college is and has been offering courses which serve as excellent educational background for those who join their forces. Their comments did emphasize the physical sciences. While they appreciate the fact that the teaching of arithmetic, algebra, and geometry may not be the function of a college, the students should be given an opportunity for review and drill in mathematics when it is shown they are deficient. They realize that in recent years the secondary schools have not stressed mathematics to the same extent as formerly.

In teaching the sciences, it was pointed out that the instruction, wherever feasible, should demonstrate the application of the theory to practice.

Several other suggestions were made by officers that are of interest to college administrators.

The Intelligence branches of the army, navy, and marine corps need persons able to read and write Japanese, Modern Icelandic, Arabic, Turkish, Persian, and Russian. They do not, however, suggest that colleges teach these languages if they are not already doing so. Colleges can be helpful if they can identify through their personnel record system non-Japanese students whose living background has given them a start in any of these languages. They have in mind the type of individual who without too much additional training could read and write one or more of them.

Examples of such cases would be the children of missionaries who have spent a considerable part of their lives in foreign countries. The names and brief biographical data of such non-Japanese students should be sent to one of the following three: Military Intelligence Division, Munitions building Washington, D. C.; Chief, Naval Operation, Office of Naval Intelligence, Navy Department, Washington, D. C.; Marine Corps Reserve Division, Headquarters, Marine Corps, Washington, D. C. The branch to which the name is referred will conduct any further investigations necessary concerning the students.

It has been suggested also that colleges can serve well the individual coming into the military forces, if they provide him on his entrance into the service with a full description of his educational and, if possible, social background. Although a transcript of credits showing the title of courses taken and the grades received is helpful, additional information would be of greater significance in many cases. The American Council is now preparing, in cooperation with the armed forces, a revision of the form originally published in Bulletin 14 for this purpose.

Results of standardized tests, work experiences, hobbies, participation in extra-curricular activities, dependability, evidences of leadership qualities, special abilities and limitations, are some of the kinds of data which will assist the military forces in better utilizing the man power coming to them.

This type of report often enables the student to understand better his own fitness for special tasks. Training in drawing up personal credentials is, of itself, a valuable asset to a man going into situations which are novel to him.

Another suggestion was made that the colleges can aid the student who will shortly be inducted into the armed forces by having him become acquainted with the organization of the various services and what is expected of the recruit. It is conceivable that in the light of the very recent programs announced by both the army and navy which affect students 17 to 19 years of age, they will need information which will give them a more intelligent basis upon which to decide the service they wish to elect. Information can be acquired from several sources.

The following selected list of references is suggestive of the material available in this field:

Soldier's Handbook, Basic Field Manual, War Department, 1941, for sale by the Superintendent of Documents, Washington, D. C., for 35 cents.

The New Army of the United States, War Department, Washington, D. C., August 1, 1941.

Blue Jackets Manual, The Naval Institute, Annapolis, Maryland, $2.

"The Citizens' Series," W. W. Norton and Co., 70 Fifth Avenue, New York City, approximately $2.50 each:

What the Citizen Should Know About the Army, Harvey S. Ford.
What the Citizen Should Know About the Navy, Harrison W. Baldwin.
What the Citizen Should Know About the Coast Guard, Hickman Powell.
What the Citizen Should Know About the Marines, John H. Craige.
What the Citizen Should Know About Our Air Forces, Harold E. Hartney.
What the Citizen Should Know About the Army Engineers, Paul W. Thompson.
What the Citizen Should Know About Our Arms and Weapons, James E. Hicks.
What the Citizen Should Know About the Merchant Marine, Carl D. Lane.
What the Citizen Should Know About the Civilian Defense, Walter D. Binger and Hilton H. Railey.

"Preinduction Education Series," prepared by the Committee on Preinduction Education of the National Committee on Education and Defense; published by Columbia University Press, New York City:

Is Your Number Up?, Blake Cochran.
Attention! To Your Health, Lieutenant Ernest I. Stewart, Jr.
Training Through Recreation, William Pitt, U. S. N.

Another phase of preinduction education was emphasized as deserving serious consideration. The man going into any of the services should be prepared to make wholesome adjustments to the new physical and social environments in which he will be placed. The college man should be given the background of appreciation to look for interesting and unusual geographic features; the historical significance of the location; government projects; memorials; museums; state and national parks, monuments, and reservations. Interest should have been developed which can be continued through the use of camp and public libraries and their facilities, both within and outside the camp, post, or station.

The officers of the various services often referred to the educational facilities which military life provides for one interested in taking advantage of such opportunites. After men are in the service, they can learn much of value to them, not alone for immediate tasks but for later civilian life. Some will be assigned to military occupations specifically related to their training and experience; others will be engaging in activities in the service not related to previous training. (A study is now being conducted in the army to determine the relationship between civilian training and experience of the individual and his job assignment in military service with a view to reassignment when possible.) The individual should be stimulated to utilize his military experience whether or not it is related to his major field of educational training as the basis for still further broadening his vocational experience and, at the same time, to the extent possible still further to develop in the field of his own major interest.

In order to provide for continuing education, some of the colleges are offering extension courses to former students in the service. Colleges near camps, in some instances, are giving special classes and lectures to which soldiers, sailors, and marines are invited. Still others are making their libraries and other facilities available to servicemen. Correspondence courses are available in all three divisions of the armed forces, and, in the army, college courses may be taken for credit. These are not

examples of preinduction training, yet they are closely related to the whole problem of integrating preinduction education with that provided by the armed forces.

In conclusion, it should be pointed out that the armed forces wish to disrupt the civilian institutions, including the colleges and universities, as little as possible. For the most part, they do not desire to dictate to the colleges what they should teach. They have a high respect for what the colleges have been attempting to do in the past and encourage the continuance of a high type of educational experience. Although individual institutions have been and probably with increasing frequency will be called upon to provide specialist training on the professional level, in almost all fields the armed forces are better prepared to train their own personnel in specific skills and job technicalities than is the typical college. In answer to the query as to what extent the armed services can conduct their own training it was repeatedly pointed out that some kinds of equipment are almost exclusively in their hands, and therefore, they must carry on their own instruction program. Then too, a great amount of the detailed information and skills of specific jobs have always been taught by the services. They have the technical equipment which the colleges cannot now procure. They look to the colleges to provide good, sound, general education. How that can be provided most effectively and in the shortest possible time is now the major problem before the college administrator.

The writer feels indebted to the many individuals whose opinions are reflected in this report. His summary represents in no way an official statement of the army, navy, or marine corps. He makes no claim to originality of any of the suggestions presented.

Record Forms for War Production Training Classes

J. HENRY SCHROEDER*

*Head of Industrial Education Department, and Director of Industrial-Vocational School, Southern Illinois Normal University, Carbondale, Ill.

The forms shown herewith were developed at Southern Illinois Normal University for use with the vocational education program for training war production workers. They have been found so helpful that they are presented here with the hope that they also may help others engaged in this work which has become so necessary at this time.

WEEKLY REPORT TO SUPERVISOR

Make this report each Friday before leaving classroom and drop in office box

Date _____ 1942

_____ teacher

Name. List active enrollment	Attendance M T W T F	Kind of job Reason for dropping	Week	Progress A B C D E
1.				
2.				
3.				
4.				
19.				
20.				
21.				

Comment _____

Industrial Vocational School

Time Sheet — SOUTHERN ILLINOIS NORMAL UNIVERSITY, Carbondale, Illinois — Class _____ Date _____

J. Henry Schroeder, Supervisor
Cooperating with Illinois Board for Vocational Education

Sign when you come in	Time in	Time out	Sign as you go out
1.			
2.			
3.			
19.			
20.			
Teacher:			
Supervisor:			

Remarks to Supervisor: _____

Weekly report to supervisors: This weekly report to supervisor is filled out each week by the teacher of each course. This is a very valuable report as it shows the complete picture for the week: attendance, enrollments, placements, and progress. It should be filed in supervisor's office. **Time sheet.** This time sheet is used in lieu of a time-clock record. Students sign as they come to work and again as they leave. Copies are filed in supervisor's office

Industrial Vocational School
SOUTHERN ILLINOIS NORMAL UNIVERSITY
Carbondale, Illinois
J. Henry Schroeder, Supervisor
Cooperating with Illinois Board for Vocational Education

ND-5 Inventory Card — Shop _____

Name of Article: _____

Accessories: _____

Specification Record		Monthly Inspection Record			
		Date	Condition Good	Condition Poor	Inspector
Size:					
Model:					
Serial No.:					
Manufacturer:					
Indent. Mark:					
Quantity:	Purchase Date:				
Cost:	SBVE: NYA Owner: SINU: WPA				

Industrial Vocational School
SOUTHERN ILLINOIS NORMAL UNIVERSITY
Carbondale, Illinois

Request for Quotation

MAIL QUOTATION TO:
J. Henry Schroeder, Director
Industrial Vocational School
Southern Illinois Normal University
Carbondale, Illinois

Date _____

To _____

Gentlemen:

Please quote us F.O.B. CARBONDALE, ILLINOIS on each of the items listed.

Quantity	Unit	Article	Price	Unit	Amount

Official Signature

Inventory card: This inventory card is a unit of the permanent master inventory kept in the supervisor's office. This record is checked periodically with that of the shop teachers in charge of the shop inventory. **Request for quotation:** This form is used in securing competitive bids on various equipment and supplies

Industrial Vocational School
SOUTHERN ILLINOIS NORMAL UNIVERSITY
Carbondale, Illinois

Inventory Card Shop _____

J. Henry Schroeder, Supervisor
Cooperating with Illinois Board for Vocational Education

Name of Article: _____

Accessories: _____

Specification Record					Monthly Inspection Record			
						Condition		
Quantity					Date	Good	Poor	Inspector
Indentification Mark								
Size								
Model								
Serial No.								
Manufacturer								
Purchase Date								
Cost								
Owner	SBVE	NYA	SINU	WPA				

REPAIR RECORD

Date	Repairs Made	By Whom	Cost

DISPOSAL RECORD

Date	Manner

Instruction: 1. List all items in stock. 2. List each item purchased. 3. Correct card each month. 4. When item is worn out or lost attach inventory card of replacement to original card. 5. Make record of repairs when made.

Industrial Vocational School
SOUTHERN ILLINOIS NORMAL UNIVERSITY
Carbondale, Illinois

J. Henry Schroeder, Supervisor
Cooperating with Illinois Board for Vocational Education

REPORT OF ANALYSES AND TESTS Report No. _____

OF _____ Date _____

BY _____ At _____

FOR _____ Your Order No. _____

The following results have been obtained after careful analyses of sample submitted and in our opinion, based on our experience and judgment, are correct.

Welding Position _____ Electrode _____

NICK BREAK SPECIMEN: _____

REDUCED SECTION TENSION SPECIMEN:
Dimensions: Width _____ Thickness _____ Area _____
Ultimate strength, Pounds: _____
Tensile strength, lb/sq. in.: _____
Break _____

FULL SECTION TENSION SPECIMEN:
Dimensions: Width _____ Thickness _____ Area _____
Ultimate strength, Pounds: _____
Tensile strength, lb/sq. in.: _____
Break: _____

FREE BEND SPECIMEN:
Orig. Width Dep. Metal, tension side _____
Final width, inch: _____
Elongation, Per cent: _____
Break: _____

FACE BEND SPECIMEN: in guided bend jig:
Angle bend: _____
Penetration: _____
Defects: _____

ROOT BEND SPECIMEN: in guided bend jig:
Angle bend:
Penetration:
Defects:

Respectfully Submitted, INDUSTRIAL VOCATIONAL SCHOOL
Southern Illinois Normal University

By _____ By _____
Supervisor Instructor

Inventory sheet: This inventory sheet is used for equipment and small tools. Each shop has a notebook in which these sheets are kept in adphabetical order, and when new equipment is added or old equipment repaired, replaced, or disposed of, a new sheet is added or a record is made of change on the old sheet. **Report of analyses and tests:** This is a complete test record of a student finishing a welding course. Any student making satisfactory test specimens in most difficult position (overhead) need not be tested in other positions. If his work required only flat or vertical positions, then tests in those positions are all that is needed

Original
Industrial Vocational School
SOUTHERN ILLINOIS NORMAL UNIVERSITY
Carbondale, Illinois
J. Henry Schroeder, Supervisor
Cooperating with Illinois Board for Vocational Education

ORDER FOR DELIVERY

MAIL INVOICE
IN QUADRUPLICATE TO: Carbondale, Ill. _____ 19___

J. Henry Schroeder, Director To _____
National Defense Agency Fund
Southern Illinois Normal University
Carbondale, Illinois

Ship articles enumerated in the quantities specified and at the prices mentioned, with all transportation charges prepaid to:

Please indicate on your invoice whether or not Federal Excise or State Retailers Occupational tax is included.

IN ACCORDANCE WITH YOUR QUOTATION OF: _____ 19___

Quantity	Unit	Article	Price	Unit	Amount

INDUSTRIAL VOCATIONAL SCHOOL

J. Henry Schroeder, Director

INVOICE

Industrial Vocational School
Southern Illinois Normal University
Carbondale, Illinois
J. Henry Schroeder, Supervisor

ND-5
Carbondale, Illinois
Date: _____

Please pay to the order of: _____
Name of Payee

_____
Address of Payee

This form to be used only when creditor cannot furnish invoice. Detailed explanation of items purchased or services rendered.

Description of items purchased or services rendered.	Unit	Prices	Amount
Total			

Approved for payment:

_____
Name of organization

By _____
Supervisor

Purchase order: This purchase order is given for every item of equipment or supplies bought. The original is sent to the supplier and the duplicate kept in our files. When order is received complete and invoices paid, this form with one copy of the invoice and the receiving room record is stapled together and filed for future reference. **Invoice:** This is an invoice form furnished to suppliers who have no printed invoice forms of their own

Industrial Vocational School
SOUTHERN ILLINOIS NORMAL UNIVERSITY

STOREROOM RECEIVING RECORD

To fiscal agent: Date

The following material was received today.

Shipper Order No.

Carrier Carry Charges: Collect Prepaid

Container
Wood Pasteboard Wrapper Drum Barrel Other

Quantity	Description

Condition of Container..... Good Bad
Remarks:

Signed
Receiving Clerk

AUTO SHOP WORK ORDER
Industrial Vocational School
SOUTHERN ILLINOIS NORMAL UNIVERSITY
Carbondale, Illinois
J. Henry Schroeder, Supervisor
Cooperating with Illinois Board for Vocational Education

Phone 475

Order No.
Date In.
Date Out.
Remarks:

Owner Phone
Address City

Make of Car	Model	Serial No.	Motor No.	License No.	Speedometer Reading:

Job No.	Repairs and service operations	Mechanic	Time	Parts Value	
				Total Parts:	
				Total Labor:	
				Total Charges:	

Inspected by: Work ordered by:

Storeroom receiving sheet: This form is a record of equipment or instructional supplies received. The original copy is kept in the supervisor's office file and the duplicate is kept in the files of the teacher or clerk who examined and received the goods. After invoice is received, a copy of it, the receiving room record, and the purchase order are stapled together and filed in the supervisor's office. **Auto-shop work order:** This work order is used in the automobile courses. It is a complete record of each job and serves as a teaching device of considerable worth. It is very useful in connection with job-analysis chart and pupil-progress chart

Vitalizing Elementary and Secondary Education Through the Practical Arts*

H. B. NASH**

Before proceeding to a direct discussion of this subject I should like to make two preliminary statements, first as to the general function of a superintendent in a school system and, secondly, as to the wording of this topic itself. In the March issue of *The Wisconsin Journal of Health and Physical Education* in an article, "A Superintendent Looks at Physical Education," the writer made a general statement which is just as applicable in the matter of industrial arts as it is of physical education. This statement reads as follows: "As an administrator I must take a whole view of the problem of education. I must attempt to so organize the school experiences of our boys and girls that they shall develop well-balanced personalities; and that their education shall be whole and complete and shall not be one-sided. It is my business to provide the inspiration and set the machinery so that the present experiences which are now included in our curriculum shall be so administered and so taught that they shall bring about these desirable results in the lives of our pupils." Just as a principal helps set the tone of an individual school, so the superintendent helps set the tone of the school system in general. This is a very necessary function, otherwise one school or one department might swallow up the whole school system.

The two words, *vitalizing* and *practical* have in the past few years been used a great deal in connection with education. We were repeatedly told it needs vitalizing and should be made practical. As an educator I am willing to accept the challenge and to admit that there is some reason for the charge, but I am just as certain that there is no one single panacea and certainly no one subject in school which can bring about this vitalization and assure that education will be practical. Through a gradual process during the years, too slowly in some instances if you will, education has been adjusting itself to meet the needs of the world in which it finds itself. This, I take it, is what is implied by vitalizing education and making it practical.

I was interested to know why the Wisconsin Industrial-Arts Association proposed a title involving the use of the words *practical arts*, rather than "industrial arts." In referring to the dictionary I find that *practical* means *usable*, and certainly if education is not usable it is not education. Then the dictionary defines art as synonymous with skill, consequently according to these definitions, the subjects which have for generations formed the backbone of the public school curriculum — namely, reading, writing, and arithmetic — are *practical arts*. It is evident that our pedagogical language is not according to Webster. It may seem that I am merely beclouding the issue by this apparently academic discussion of terms. On the contrary it is impossible to think clearly through this problem unless we are agreed on the meaning of the terms, or at least unless you know the speaker's interpretation of them. On referring to educational literature it seems to be pretty generally established that when we talk of art we have very definitely in mind *manipulation* and *production*. The direct end of the work has been the construction of something, hence we have had such terms as fine arts, industrial arts, home arts, and now practical arts. Practical arts then means the producing of something which has some use or function. If this be the interpretation of practical arts, I think it has a distinct advantage over the term industrial arts but I am not sure it would be welcomed by all industrial-arts teachers. To me it does not preclude industrial arts — or the arts practiced in industry — but does take in the larger field of what we now know as art and craftwork; of home mechanics; and of home economics. A breakdown of

*Address given at meeting of the Wisconsin Industrial-Arts Association.

**Superintendent, Public Schools, West Allis, Wis.

these fields from the standpoint of general education is very desirable. It is deplorable when the art teacher in school cannot see *art* in the work of a pupil who is using wood as a medium, but can see it when the student is working with a clay as a medium, or on the other hand when the industrial-arts teacher feels that art is something to be used in the art department or that it is too highbrow to be used in the shop. Under the designation practical arts the shop would be a workshop in which the pupil may be using any medium through which he can best express himself and gain the most worth-while educational experiences. It may be woodwork; it may be painting, bookbinding, lathe work or any of the other shop experiences that could be included under the term practical arts. I presume objection might be raised to this by both the industrial-arts and art teacher; particularly where art teachers are interested mainly or entirely in what is known as fine arts. Could painting and sculpturing be included in the practical arts? Such work is usually conceived of as the highest form of art. Such a product need have no utilitarian value for it may exist only for its own sake in compliance with the theory that "beauty is its own excuse for being." There, however, may be a question as to whether or not, in the broadest sense, this could not be called *practical* art. This type of art is so seldom found in the public school that for our discussion here it may be ignored. This, then, leads me to what may be considered my first statement relative to my responsibility in this matter as an administrator. It is to help bring about this wholesome conception of practical arts and to help put this conception into practice. Such a conception will, it is sincerely to be hoped, break down the somewhat artificial distinctions now existing in the average school departmentalizing home arts, industrial arts, prevocational, and general art.

Speaking in terms of our particular topic I think it is necessary many times for the superintendent to sell practical arts to the industrial-arts teacher — to sell it in terms of its proper place in the program of general education; to show that it is not merely a question of sawing wood, of setting type, or of modeling clay, but that the activities that take place in the general school workshop have a general educational value, and that the product is of less value than the experiences which the boy is receiving. By using this organization it does not mean that shop practice would become contrary to the best practices in industry or that the necessary induction into industry, now prevalent in industrial arts, would be excluded. On the contrary, since art has entered the industrial field to such a tremendous extent this emphasis must also be put into the art work. Hence you cannot think of a practical-arts shop as divorced from industry. It is also necessary to sell practical arts to the academic teacher in order to help him to realize that it is just as fine an achievement for a boy to attain a high degree of skill in handwork, or in the manipulative arts, as in the so-called academic work; that homeroom teachers do not just push the dumb boys and girls into the practical arts and reserve the academic work for the brighter boys and girls. Industrial intelligence is just as desirable as academic intelligence. The boy who gets *A* in practical arts should be made to feel the self-same satisfaction as the boy who gets an *A* in mathematics. If this can be sold to our academic teachers it will help change the conception now prevalent amongst boys and girls, and also the community in general, relative to manipulative work. The practical arts do not have to apologize for their existence in the public school curriculum; they have a rightful and legitimate place; indeed they have probably helped more than any other subject to keep academic education with its feet on the ground. Where else can one find a better opportunity for self-expression, for creative work, and where can one find better provision for individual differences than in the practical-arts shop? Here also provision can be made for group cooperative enterprises. In my opinion, practical arts should be required of every boy and girl. It has particularly unique value for the boy or girl who expects to belong to or to marry into the professional class. They should get the *feel* of shopwork, of working with the hand, and sense the ability required to do such work. No theoretical training in social studies can take the place of these experiences in preparing the boy or girl, who in later life will have no active participation in these fields, to understand industry, its achievements, its problems, and society's complete dependence upon the man who works in the shop. What more dramatic illustration of this than at the present time in our war production program! How could we carry on war and defend our country without shopwork? Work in the practical arts will, of course, in later years take on the nature of prevocational or even vocational training. We do not need to fight shy of this. Education must help to fit a man for a job. The modern high school has a function in this respect — even in Wisconsin where vocational and general education are separated.

Our second responsibility is to provide a trained leader in each school system. Of course, I realize that this problem takes on a different aspect depending upon the size of the school. In every school system where an administrator must delegate supervisory responsibilities he should provide a head or supervisor in the industrial-arts work. Of course if our schools were so organized and persons were so trained, this could be a supervisor of the practical arts in which would then be included the work now known as art, home economics, and industrial arts. But since this is not the way we are organized we must consider this in terms of industrial arts and as such it cannot be expected that this work will be co-ordinated unless some such person has been designated and charged with this responsibility. In smaller school systems such a person may even have a full teaching load and in addition be chairman of the industrial-arts department. As such he will be given responsibility for seeing that a right sequence and spread of experiences is offered in industrial arts and, after consultation with the rest of his teachers, recommend the equipment and supplies that are necessary for the carrying out of these experiences. Such worth-while supervisory activities can be carried on without classroom visitation. At least it is the administrator's responsibility to see that the work is co-ordinated; that it is not pushed around by the principal, as may sometimes happen, since school principals, like superintendents, obtain their training in the academic field, and may not see their responsibility toward the practical arts as they should.

In the third place the administrator must select trained teachers. Considerable time could be spent in discussing just what is a trained teacher in industrial arts. In hiring industrial-arts teachers, as in hiring other teachers, I am just as much interested in their educational philosophy, in their understanding of boys and girls, in the kind of personality they have, as I am in their technical training. It is necessary that the industrial-arts teachers meet the same requirements as the academic teacher. On the other hand, they must be craftsmen who have definite standards. They should also have some knowledge of industrial practices and I am not sure but what our teacher-training colleges should not incorporate this as part of the training for industrial-arts teachers. It could well be given training school credit and form part of the required course. In the rightful emphasis which has been put upon the professional training of industrial-arts teachers this phase of training which used to be required has been somewhat lost. Teachers in our vocational schools have to have it. It is for this reason that in many instances industry feels today that a machine-shop course taken in the vocational school is more valuable than a machine-shop course taken in the high school even though the same sequence of experiences may be offered in each instance. As to what should go into the actual shop training in our teachers' colleges I probably am not qualified to judge, but based on experience as to how teachers perform, I have certain ideas. Though specialization in one medium may be desirable it is certainly true that all should have some experience in mechanical drawing work, woodwork, and metal. Another very definite experience which should form part of the training of in-

dustrial teachers is training in art. This should be required of all industrial-arts graduates. You have said, and rightly so, that your work is *art* and it would do much to raise the standing of your work, if industrial-arts teachers took training in the principles of art and design. I cannot too strongly emphasize this because to me it represents at the present time one of the greatest weaknesses in the training and work of the industrial-arts teacher.

A further responsibility of an administrator is to help provide adequate facilities so that the industrial-arts teacher can have the kind of shop with the kind of equipment in which he feels that he can do those things which are required of him. One of the major problems in this is a matter of securing funds, because when it comes to cost there is just no comparison between the cost of equipping classrooms for industrial-arts work as compared with the equipping of classrooms for academic work or even for any other subject in the field of the practical arts. I know very definitely what I am saying in this respect, because, since my term as superintendent we have equipped shops in two new junior high schools and one senior high school together with two new shops in the old senior high school. This has taken money, some of it being obtained in a time when money was pretty scarce, but I am happy to state that the shops which were equipped during the lean years were equipped just as well as the more recent shops equipped in these times when money is more plentiful. In order to secure adequate funds you must have a real faith in the function of industrial arts and you must have some very definite plans showing what you need, where you need it, and why you need it. You must sell the work to the community and demonstrate to the board of education the need for such expenditures of money. If you have not this faith in industrial arts and are not willing to give to the men adequate equipment so that they can give the pupils a *real job to do,* it might probably be better to omit these types of experiences. It has been my good fortune during these years to have had the advice of a supervisor who knew very definitely what was needed to do the kind of work we wanted done and who gave us definite shop plans and specifications which were always presented to the board before any money was requested; and while some items which have been requested by the industrial-arts department have not been supplied, in the main this department has been given all it asked for. While good equipment does not secure good teaching and while much worth-while teaching is done without the best equipment, is it perfectly evident that we cannot expect these men to do the kind of job we want them to do unless we give them adequate equipment?

Promotional Displays

R. RANDOLPH KARCH*

In many cities facilities are available in public libraries, department-store and bank windows to display the work done in vocational high schools and to promote public interest in the schools.

The accompanying illustration presents a display of the work done at Printing High School in Cincinnati. It will be noted that the theme of the display "Printing is Necessary for Defense," copy in the center panel reads as follows:

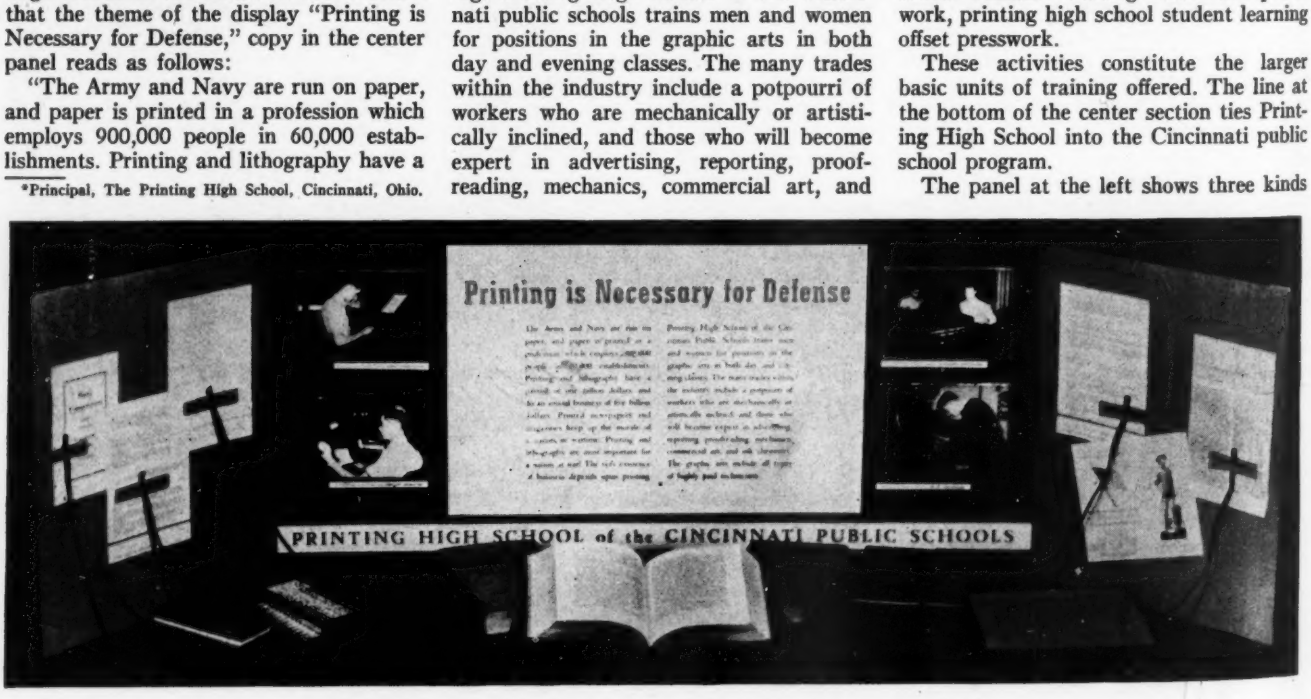
"The Army and Navy are run on paper, and paper is printed in a profession which employs 900,000 people in 60,000 establishments. Printing and lithography have a pay roll of one billion dollars, and do an annual business of five billion dollars. Printed newspapers and magazines keep up the morale of a nation in wartime. Printing and lithography are most important for a nation at war! The very existence of business depends upon printing. Printing High School of the Cincinnati public schools trains men and women for positions in the graphic arts in both day and evening classes. The many trades within the industry include a potpourri of workers who are mechanically or artistically inclined, and those who will become expert in advertising, reporting, proofreading, mechanics, commercial art, and ink chemistry. The graphic arts include all types of highly paid technicians."

On each side of the center panel appear photographs with explanations as follows: printing high school student learning hand composition, printing high school student learning linotype operation, printing high school student learning automatic presswork, printing high school student learning offset presswork.

These activities constitute the larger basic units of training offered. The line at the bottom of the center section ties Printing High School into the Cincinnati public school program.

The panel at the left shows three kinds

*Principal, The Printing High School, Cincinnati, Ohio.



Display prepared by The Printing High School, Cincinnati, Ohio

of type composition: hand, linotype, and Ludlow. The actual type which is printed upon the sheets is connected with ribbons to the display proper. On the right-hand panel the two complete jobs of printing are shown along with the typed forms.

This section also shows a lithographic plate and a proof of it. Standard printing textbooks used in the school make up the center of the display.

This was a cooperative project of the hand composition and photography teachers. Mr. Frederick A. Auburn, who teaches photography and lithography, provided the glossy prints and Mr. E. Frank Glatthaar made the display as a whole.

Does Aviation Have A Place in the School Shop?

J. W. GIACHINO*

In 1903 when the Wright brothers launched their first airplane at Kitty Hawk, N. C., little did the world dream the effects this event would have on modern civilization. Like many of our great inventions the acceptance of aviation by the general public was gradual, and its value was realized only after it had been subjected to innumerable obstacles. Today, in this far-flung social and economic devastation, the airplane has become both an implement of destruction and salvation. But destruction in this sense becomes tolerable and justifiable because it is directed toward crushing those forces that are threatening our inviolable human rights. When it has helped accomplish this end, the airplane can once again return to the role for which it was originally intended, and continue its efforts toward being an important peacetime asset to civilization.

When this time does arrive, aviation is due for a tremendous expansion, one that may be staggering to the imagination and perhaps difficult to conceive at the present time. Such a prophecy is not based on intangible elements but rather on the hypothesis that the potentialities for this expansion are rapidly gaining momentum. Briefly viewing the picture at the present time, we find that there is a prodigious enlargement of facilities all over our country, for turning out thousands of military airplanes. Millions of our youth are being taught to fly. Vast researches are under way seeking methods for designing and building better airplanes. Although many of these enterprises have been accelerated due to the war, they are not going to be discarded when peace is restored. Leaders in our aviation industries are already contemplating and proceeding with plans to utilize the gigantic resources to turn out countless types of aircraft for every practical purpose. Undoubtedly one of the things that will materialize early is the production of a "foolproof," low-priced airplane that the average individual will be able to fly safely with comparative ease and without any lengthy period of instruction. This ship will probably be of a type that can rise and descend vertically in the owner's back yard, or it may be one that can be driven like an ordinary automobile on the highway, and when a suitable taking off place is reached, a turn of a switch will convert it into an airplane. We will also witness tremendous freight- and passenger-carrying ships flying regular air lanes all over the universe. In fact aviation is destined to become the leading transportation industry.

If this is the picture of the future, and there is no reason why it cannot become a reality, it is easy enough to realize the opportunities that will be opened for youth interested in this field. There will be many openings in the different branches of engineering, manufacturing, servicing and in countless allied occupations all demanding skilled men. Those of us engaged in teaching industrial education have always taken pride in keeping abreast of modern industrial developments and have added, expanded, and enriched our courses accordingly. Therefore, it becomes our responsibility to begin thinking about what we, as shop teachers, can do to help our students take advantage of these future opportunities. For years, the writer has been advocating the incorporation of various units of aviation work in the industrial education curriculum. This need not be considered a stupendous task or insuperable for the average school. With a little planning such a program can be readily instituted and prove exceedingly popular with the students. Moreover, such a plan would give those interested in aviation an opportunity to ascertain whether or not their interest is sufficient to warrant their continuance with future preparations in this field.

It would seem entirely feasible to start such a program in the junior high school, offering at this level a course in model airplane construction. In the senior high school, if regular aviation classes cannot be justified, various phases of the work can be added to existing shop courses. For example, in drafting it is possible to have a few units dealing exclusively with aviation problems. Those students having an interest in aviation could then have the privilege of substituting these problems for the conventional ones. Nothing would be sacrificed — the students can just as readily learn drafting techniques by drawing airplane parts as they can by devoting their time to other objects. This can also be done in the woodworking classes. Here the aviation-minded individuals would learn woodworking principles by making ribs, spar sections, wing assemblies, etc. In sheet metal there are numerous airplane parts that could easily be adapted as substitutes for the regular projects. The same thing can be accomplished in the machine shop, bench metal, auto mechanics, patternmaking, etc. If the school is run on the general shop plan, these aviation units can also be utilized along similar ideas.

In contemplating such a plan two problems become apparent, but each upon analysis will present a satisfactory solution. First, there is the question of equipment. Unless a school is planning on a complete aviation curriculum, no serious obstacles are imminent. Most school shops are adequately equipped to handle these small units of work and whatever is lacking can easily be constructed. Moreover, it is always possible to secure old or damaged airplane parts from some local airport. Of course, when this war is over it will be a relatively simple matter for schools to secure any amount of equipment from the government.

From the offset, the second problem concerning the ability of the present instructors to teach the material, may appear somewhat more involved. However, most shop teachers are sufficiently trained in the basic skills so that they can readily adapt themselves to take over this phase of instruction. It will mean, of course, that these teachers will have to become acquainted with the skills and various informational units associated with these operations. But once having the terminology, the fundamental use of tools and procedures are sufficiently similar to present very few difficulties. Undoubtedly in the very near future, teacher-training centers will offer short courses covering such units of aviation work.

It is the writer's hope that these institutions will realize the need for training people in aviation and begin making plans so that the people in the teaching field, as well as new prospective teachers can avail themselves of the opportunity to pursue enough study along this line to be able to institute an aviation program in their respective schools.

*Western Michigan College, Kalamazoo, Mich.

INDUSTRIAL ARTS AND VOCATIONAL EDUCATION

John J. Metz, Editor

Progress Depends Upon Education

Have you ever thought about the ease with which amateurs now make strikingly good photographs? Think back a moment and mentally estimate how many cameras you saw in the hands of other vacationists this summer. Some of the cameras were inexpensive instruments and the box-camera type, others were reasonably priced pieces of apparatus equipped with focusing and other adjustable devices, and still others were high-priced contrivances equipped with marvelous lenses, and every type of imaginable convenience for picturemaking.

Present-day amateur photographers use these various types of cameras without reflecting that every improvement on this interesting instrument has been added within the past hundred years. According to an article which appeared in the October, 1941, *Esquire*, the lens which made present-day photography possible was developed by Joseph Petzel in 1841. In 1890 Zeiss introduced his first anastigmat lens. Soon after H. Dennis Taylor of England invented the "Cooke" triplet lens which rivaled the anastigmat produced by Zeiss.

Then came the scientists who improved photographic chemistry, and others who invented the exposure meters, and lastly those who made possible the beautiful results of color photography.

It must be remembered that all of these striking improvements were made within the past hundred years, many of them within the past ten or fifteen years. The men who made them are products of an educational system which we hear so frequently derided as being full of inefficiencies of many kinds.

Humbly admitting their many errors, educators may still point with justifiable pride that they have added their bit to making modern progress in so many fields possible. Shop teachers, too, are doing their share in laying the groundwork for the many mechanical wonders which one meets. The fact that camera shutters can now be set to operate at one five-hundredth part of a second or to give even shorter exposures depends upon mechanics, not upon chemistry or upon lens making. The artisan who produces these devices that operate at such speeds needs a great deal of training, and the school shop may well be looked upon as the place where the foundation for acquiring this kind of training is obtained.

Education as we know it is not perfect. It is the duty of teachers in every field of modern education to strive for betterment in his particular sphere. In the meantime, however, educators may well call attention to the fact that their output, the boys and girls who have and are now attending school, are the ones who are making progress possible in all fields of human endeavor.

Pilfering Copyrighted Books

The National Music Council recently made public a complaint against a growing practice in the pilfering of copyrighted compositions in the following language:

> The illegal copying and arranging of copyright music in schools, colleges, universities, and conservatories and by private teachers is increasing, according to information received over a period of time by the National Music Council. This practice is in direct violation of the Copyright Act, which gives the copyright owner the sole right to print, sell, arrange, and adapt his works. Such illegally copied or arranged compositions are being distributed to students, either on the basis of a small monetary payment, or as part of their music courses. Copyright music for orchestras, bands, and choral groups is also being illegally copied.

The complaint here applies generally to the unauthorized use of the educational textbook materials. Publishers have called attention repeatedly to the evil without entering upon legal proceedings to eliminate the same.

The infractions of the copyright law occur where instructors are actuated by a desire to serve their classes with minimum expenditures for books. Not all students are able to buy the books, hence chapters and paragraphs are copied from books and distributed gratuitously. The teachers frequently are not conscious of any wrongdoing. They are actuated solely by the spirit of economy and expediency.

The pilfering thus engaged in may not particularly be disturbing to the publisher, at least not to the point where he is willing to resort to the courts for redress. The thought, however, must be borne in mind that the author who in most instances is a fellow teacher, is deprived of a part of his or her royalty on the sale of the textbook which has been used without consent. The copyright law is quite severe and the penalties for infringement, both criminal and civil, are rather serious.

Get Your Preference Rating

Those who order equipment, tools, and materials for the school shop should carefully ascertain what types of materials may be obtained without preference ratings, and what types need such ratings.

It is plainly evident that by doing this before sending in an order, much time may eventually be saved. A manufacturer or dealer may have on hand the article described in an order. If that article, however, requires a preference rating, and the order does not contain a priority number, a series of letters must go back and forth between the one who wants to sell the goods and the one who wants it.

To avoid these unnecessary delays, make sure that a preference rating certificate accompanies all orders that require one. The A-10 priority granted schools is of little use to the school shopman who desperately needs new vises, for instance. Some school shops have obtained priority numbers as low as A1-J for some of their needs.

Apply to your local or regional WPB representative, for such preference rating as you are entitled to and be sure to send the certificate thus obtained with your order.

Maintain Staffs

It seems advisable that school boards make every effort and bring every sacrifice of funds to maintain their teaching staffs by retaining experienced teachers and by seeking the return into the schools of competent men and women who have taught at one time. British teachers and school authorities, speaking with the experience of nearly three years of war, urge the advisability of retaining teachers in their jobs and of preventing men who cannot easily be replaced from entering the armed forces. This seems to apply especially to men who teach mathematics, science, the industrial-arts and vocational subjects, and of all men of more than five years' experience.

The job of the schools during the coming year will be equally in the direction of winning the war and of winning the peace which will come after the victory. To fully serve the 29 or 30 millions of young people who are to enjoy the peace is the present great service which the school boards and the teachers must render as their contribution to the war. It is a most serious duty which only complete staffs of the most competent and experienced teachers can render.

The Safety Program

The beginning of the school year is a good time for inaugurating a good safety program for the school year. Industry has worked for a long while to cut down loss of time due to work accidents. It has accomplished much over a span of years, yet the accident toll is still very large.

The school shop is the training ground for the mechanic of tomorrow. It is here that he gets his first opportunity to do supervised work with materials and tools. It is here also that he ought to learn how to work safely, because the best mechanic, if he is not a safe worker, is but a menace to himself and others.

Planning the safety course, therefore, is very important. It is a task that cannot be slighted, and it must be remembered that it must consist of messages that may not be allowed to die. It must be something that is held up to the student continually, and the student must be thoroughly impressed with the idea that only the safe worker is a good worker.

Waste Nothing

Today's slogan, "Production Wins Battles," means much to America. It can be made a strong inducement to influence students to learn how to do their work well in the school shop.

Of course, the boy on the junior high school level can be expected to obtain a general overview of but a small section of man's activity in our industrial civilization. But even at this lower level, the student must be acquainted with the need for acquiring some degree of skill, and the further need of accomplishing set tasks correctly and without loss of time.

Translated into adult industrial accomplishments, it may be stated that this war will be won by the side that can produce the best equipment in large quantities in the shortest possible time.

Boys can understand this type of reasoning and an appeal to their patriotism may help many of them to develop the right attitude toward their shopwork at the school.

It will also give them an insight into the unpatriotic attitude shown by some workmen who are said to boast about the fact that by not killing yourself during the regular working hours, time and one half may be obtained for overtime. They deliberately waste time, cut down production, and practice dishonesty to earn or rather steal more money.

In the same way students may be taught how necessary it is to waste nothing. There was a time when a few nails meant nothing. One could forget those that dropped to the floor among the shavings. Today, even a few nails or screws acquire value because they cannot be produced as fast as they are demanded by the war-production industry.

Viewed in this light, deliberate or careless waste of time and materials assumes the appearance of disloyalty toward our country — an extending of aid or comfort to the enemy.

These conditions also affect industrial arts and vocational education

A Worth-While Attitude

The slogan, "Important things are taken care of at once; the impossible require a little more time," which has been put up in one of the large new bomber plants, contains a thought that might well be pondered upon by everyone.

Men who could not be downed have always done the things others thought impossible of accomplishment. If every student in our schools could be imbued with the idea that every task is worthy of a real effort, and that failure is the result only of not trying, the final outcome of this war could be predicted with a certainty that could not be questioned.

Diversified-Occupation Plans of Vocational Education

HARL R. DOUGLASS* and ALONZO D. KORNEGAY**

The school curriculum can never be adapted to provide sound, definite vocational training for all the vocations in which Americans are employed today. With some exceptions, vocational education in the schools must be basic and somewhat general. For a majority of occupations definite training must be received *on the job*. The *Diversified Occupations or Cooperative Plan* provide for that.

Because educators are beginning to recognize the validity and the importance of these considerations, approval of the idea and practices of the diversified occupation plan is spreading rapidly. In 1936, one of the authors of this report strongly recommended the idea to the American Youth Commission in his report to that body as their consultant on secondary education, and again in an address before the North Central Association of Colleges and Secondary schools, and again in an article.

1. *Secondary Education for Youth in Modern America*, American Council on Education, 1937, pp. 80–89.

2. "Youth, School, Work and Community," *School and Society*, 50:65–71, July 15, 1939.

3. "Youth and the Schools," *The North Central Association Quarterly* 13, pp. 224–231, October, 1938.

The idea and the plan of part-time cooperative school and job participation is not original or novel. It has existed in this country for half a century in a few schools —notably the University of Cincinnati, Park College, Antioch College, and the public schools of York, Pa., and Cincinnati, Ohio. Yet as late as 1934, not more than 166 schools in the United States could be found in which the plan was in effect. Since that time the number of schools has increased rapidly, very rapidly since the passage of the George Deen Act in 1937, particularly in the Southeast.

The Scope and Plan of the Study

To discover how rapidly the plan was spreading in the southeastern states and how it was being employed in that area, a check list was sent to all schools in eight southeastern states which were reported to be employing diversified occupation plans. One hundred and seventy-three schools were located in operation in 1938–39. It is probable that others were being organized and put into operation in the year which would bring the number to 200. Replies from 120 of these schools constitute the basic data of this study. With one exception, none of these programs was more than five years old. See Table I. More than half had been established the year before.

The programs were found in cities of all sizes, 16 of them being in cities of less than 2000 people and 24 in cities of more than 50,000. Of the 173 programs, 49 were in cities of from 2000 to 5000 people.

State	*Year*	*34–5*	*35–6*	*36–7*	*37–8*	*38–9*	*No reply*	*Total 38–39*
Kentucky		0	0	0	1	9	3	12
Virginia		0	0	0	5	17	3	20
Tennessee		0	0	0	0	4	0	4
North Carolina		1	1	1	4	8	3	11
South Carolina		0	3	8	16	22	10	32
Mississippi		2	8	9	12	17	12	29
Alabama		1	4	8	19	21	8*	29
Georgia		0	0	0	4	7	12	19
Florida		3	4	8	10	14	3	17
Total in Southeast		7	20	35	71	119	54	173

TABLE I. Number of Schools in Each State With D. O. Programs By Years, 1934–38

Of the 120 schools from which replies were received, 2940 persons were involved. Of these, approximately 26 per cent were boys and 38 per cent girls. On the average, 25 young people were engaged in the program in each school. Approximately 80 per cent of these pupils were in the upper two grades of the high schools. About one in ten was a postgraduate. Three per cent were in the first year of high school. Their average age was 17.3 months, very few being less than 16 years of age.

The Student Program and Occupation

On the average the D. O. student in the Southeast spent 2.5 hours in regular schoolwork. In Georgia and Tennessee the average was 2.1, and in South Carolina and Kentucky it was 3.0 and 2.9 hours respectively. He spent on the average 1.7 hours, usually from one to two and one half hours, daily in study related to the occupational field in which he was engaged. On the job he spent daily on the average 3.7 hours, rarely less than three hours or more than 4.4 hours. In addition, he spent two hours daily on study related to his work.

Altogether, 168 occupations were represented. Those represented in 10 or more of the 120 schools are shown in Table II.

Occupations represented in from 4 to 9 schools inclusive are: cabinetmaking, movie projection, library work, stenographic work, bookkeeping, plumbing, welding, window decorator, hardware, stock work, general newspaper work, wholesale dealer, shoe repair, men's clothing salesman, variety-store operation, electrical repair, baking, drafting, photography, refrigerator dealer, news reporter, shipping clerk, auto-accessories dealer, sheet-metal work, show-card making, florist, telephone operator, restaurant work, radio broadcasting, radio station technician, architectural drafting, ladies ready-to-wear dealer, insurance salesman.

Rank	*Occupation*	*Number of Schools*
1	Retail Selling	103
2	Auto Mechanics	76
3	Radio Repair	37
	Electrician	37
5	Printing	36
6	General Office Work	34
7	Grocery Business	32
8	Practical Nursing	28
9	Beauty Culture	26
	Machinist	26
11	Secretary	23
12	Service-Station Operation	15
	Undertaking and Embalming	15
	Textiles	15
15	Dentistry	14
	Meat Cutting	14
	Body Repair	14
18	Pharmacy	13
	Department-Store Work	13
20	Banking	11
	Carpenter	11
	Dry Cleaning	11
23	Theater Work	10
	Dry Goods Dealer	10

TABLE II. Number of Schools Using Various Occupations for D. O. Training, Listed According to Rank

Other occupations represented were: airplane mechanic, neon sign manufacturing, telephone switchboard operator, candy-making, lumber estimator, advertising, Diesel engineering, shoe-store clerk, laundry operator, commercial artist, doctor's

*Director of the College of Education, University of Colorado, Boulder, Colo.
**High School, Kannapolis, N. C.

*One of these replied to the questionnaire but did not fill in this question.

assistant, cotton classing, transportation agent, stock marking, air conditioning, accountant, typing, chemical laboratory technician, public service, dietician, painter, motor repair, interior decorator, optical work, journalism, furniture salesman, dairying, bus station assistant, housekeeping, upholsterer, telegraph operator, creamery operator, designing, hotel and cafe operator, sign painting, railroad operator, dental hygienist, food demonstration, dressmaking, general clothing salesman, cooking, oil distribution, shoe building, candy sales, ice-cream manufacturing, office supply salesman, pipe fitting, hat sales, stockroom assembly man, safety engineer, paper chemist, plant maintainer, production, specialty stores, electric stores, farm machinery salesman, news agent, monotype operator, building contractor, air pilot, building material salesman, jewelry salesman, Y.M.C.A. athletic trainer, collector, recreation leader, water-works salesman, marble cutter, power plant operator, supply-room manager, key and gunsmith, cafeteria, typewriter repair, electric-light maintainer, health hygiene, architect, tire rebuilding, building maintenance, public utilities, X-ray technician, management, building trades, gas company, chain-store manager, veterinarian, meat packing, coal dealer, armature winder, photo supplies, meat curing, ice making, real estate, patternmaking, steel fabrication, tearoom, dental technician, commercial work, monumental stone cutting, peanut processing, linotype, bottling works, loom fixer, hosiery knitter fixer, dry goods buyer, generator repair, boatbuilding, millinery, newspaper circulation, newspaper advertiser, millwork.

Most of the occupations less frequently found were similar in general nature to those listed in Table II.

Naturally, the number of occupations in which students in a given school received training varied with the size of the city. On the average there were 11 occupations to a school, though in some schools the number ran into the thirties and in others only three or four.

In line with recommended practice, 96.6 of the students were paid for their work. The average rate of pay was 16.7 cents an hour — only 15 cents in Alabama as the average, and 19.2 cents in Florida.

In general, youth start the training at the age of 16 years and continue for either one or two years. The average time was 1.6 years. About 88 per cent completed their courses, 79 per cent in Florida, and 96 per cent in Tennessee. On the average 65 per cent of the students at the completion of their course go into the same or very similar jobs, 55 per cent in Georgia, 57 per cent in South Carolina and Mississippi, and 75 per cent and 71 per cent in Alabama and North Carolina respectively. In addition, almost half of the others go into work of a nature similar to that in which they had their D. O. experience.

The Co-ordinator and the Employer

On the average, each program required the full time of one *co-ordinator,* though in approximately one third of the schools, two or more co-ordinators were employed.

The replies indicate that in practically all schools the co-ordinator *sells* the program to the employers in the locality, and, with the assistance of principal and teachers, recommends pupils to the employers.

The co-ordinator trains the students in applying for jobs and supervises his work, though the immediate supervision necessarily falls upon the employers or a superior employee. In only six of the 120 schools does the co-ordinator not attempt to visit the student on the job. Written reports from employees are not the general practice.

With respect to protection of the student from exploitation of employers seeking to find a source of cheap labor, the practices in the southeastern states leave something to be desired. They fall far short of recommended practice. In only 22 schools is there a written agreement between pupil, parent, employer, and school. Only 19 reported that the co-ordinator sees to it that the employer has a thorough understanding of aims and purposes of the program.

In some schools the co-ordinator apparently thinks his responsibility is little more than to make arrangements with the employer and to see that the pupil gives satisfaction. Only 17 schools reported a definite plan of supervision to see that the pupil's work is adapted to his educational needs and to his progress in learning the vocation, and only 10 reported a practice of removing pupils from work where exploitation would not be eliminated. Only 28 of the schools report a practice of regular conferences between co-ordinator and employer or trainer.

It is apparent from the above that while the D. O. program with its splendid possibilities is spreading in the Southeast, in many cities it has far to go with respect to its plan of administration. There is much work to be done in giving co-ordinators a greater vision of their responsibilities and of a greater zeal for practice that is socially sound.

In an increasing number of cities, now about half, an advisory committee of representative citizens is employed in formulating the policy of the program and in educating the community to the program.

Miscellaneous Findings

Among practices or conditions reported the following were included:

The Fayetteville High School, in North Carolina, has made a 16mm. film to explain the D. O. program to pupils and patrons.

The Waynesboro High School, in Virginia, began its D. O. program three years ago as a summer experiment. This proved so successful that last year it was included in the regular school program.

One co-ordinator in Alabama has divided his time between two near-by schools.

One state leader reported that he had always explained his program in detail to labor leaders and consulted with them regarding problems. He has also used an equal number of employers and employees on his advisory committee. Thus the support of labor has been assured.

Several Negro schools are now using D. O. successfully.

One co-ordinator reported that the program tied the school and community closer together.

The Lee Edwards High School, in Asheville, N. C., issues a very interesting and informative duplicated bulletin explaining the program to pupils and patrons.

Many other schools use handbooks and duplicated material to inform the students and public.

The schools of Jacksonville, Fla., publish material informing the public of the program. Among the most interesting and helpful things included are testimonials of employers expressing support and appreciation of the program.

One co-ordinator reported that it was important to select only students with ability to pass work requirements, as inferior students would not satisfy employers.

Many schools have developed forms and blanks for employers' reports, records of job training, related study sheets, rating of student on the job, student application form, students' daily report card. Among the better forms were those from the following schools:

Parker High School Greenville, S. C.; Duval Co. schools, Jacksonville, Fla.; Huntsville public schools, Huntsville, Ala.; Montgomery public schools, Montgomery, W. Va.; and Covington High School, Covington, Ky.

Additional Benefits of the D. O. Program

In addition to the beneficial effects of work-experience and its possibilities for vocational guidance and vocational training, there are other very important advantages. One of these is the opportunity for young people of poor parents to earn a little and thereby to keep up personal appearance comparable to that of their fellows and to permit them to engage, at least in limited degree, in the social life of those from homes of superior means. The beneficial effects of these opportunities upon the development of a healthy personality are far more important than many educators have realized.

Another very important advantage lies in the more favorable attitude and the useful background developed for learning vocational, civic, scientific, and other subjects studied after the student has had considerable contact and experience with adults and adult vocational situations.

Still another desirable outcome is the tendency to place the nonwhite-collar occupations in a more favorable and more reasonable place in the thinking of high school pupils and teachers. There is also value in the provision for young people to work gradually into a job and its full responsibilities.

If youth is to be served, if social planning is to compensate for the disadvantageous environments of youth as compared to that of previous generations, the D. O. work-study idea must continue to spread and to be protected from faulty and harmful practices. It must be accepted as an important part of every city and village school program and put upon a thoroughly sound educational basis.

Aeronautics Course for A Technical High School

FRANK E. BOHATA*

Several years ago the writer developed a course of study for an aeronautic construction shop which has served its purpose well and may still be found very helpful.

While flying is not included in this curriculum, the student learns the theory of flight and becomes familiar with the air commerce regulations. The student gains an undertsanding of the construction of airplane mechanics, and skilled workers, such as welders, sheet-metal workers, woodworkers, and machinists.

Each student, upon entering the shop, is assigned his bench and given a set of job sheets. The purpose of these sheets is to train the boy to work from blueprints and to develop in the boy the ability to work without constant supervision.

opportunity for growth and self-advancement.

The students are required to lay out their own patterns, templets, and jigs, and to construct the ribs from their own jig boards.

The writer chose a small sport byplane of modern design and standard construction, simple enough to enable boys of

Syllabus and Course of Study
Aeronautic Construction Shop

Theory	*Practice*	*Theory*	*Practice*
Use of measuring, marking and testing tools: Rule, try-square, steel square, sliding T bevel, protractor, marking gauge, dividers, straightedge.	Lay out stations on the datum line. To construct a rule. To plot ordinates for upper and lower camber.	*Compression member:* Strut, rib.	To build up two compression struts.
Use of cutting tools: Planes, chisels, gouges, saws, and knives.	Squaring up rib jig board.	*Leading and trailing edge:* Method of fastening.	To make the leading edge. To make the trailing edge.
Wings: Purpose, number, general construction, aileron location, center section, nomenclature.	To lay out wing profile on the rib jig board. To locate distances for spars, braces, and posts.	*Fittings:* Layout. Use of boring tools, brad awl, twist bit, twist drill, auger bit, expansion bit.	To make metal fittings. To make turnbuckles. To make ferrules.
Wood used in airplane construction: Spruce, ash, mahogany, balsa, hickory, cherry, white pine, black walnut, and basswood.	To complete the rib jig board. To saw out three nosepieces.	*To assemble the wing section:* Alignment, theory, procedure.	Assemble wing section. To make a trammel bar.
Fastening materials and tools: Nails, bolts, glues, claw hammer, mallet.	To fit upper and lower cap strips to nosepieces. To fit posts and braces.	*Fabric:* Materials used, requirements, advantages, and disadvantages.	To apply fabric.
Abrasives, classification, and use: Files, rasp, sandpaper.	To nail, cut, and glue gussets on ribs. To saw out two solid end ribs.	*Covering process:* Blanket method, envelope method, seams, sewing.	To sew the trailing edge. To apply reinforcing and surface tape.
Ribs: Pratt, Howe, plywood.		*Dope:* Acetate and nitrate. Stains, varnishes, paints, shellac.	To apply dope. Use of wood preservatives.
Spars: Solid, box, I beam, hollow routed.	To build up two spars.	*Group project:* Teach cooperation. Plan layout work to a successful conclusion. Jig, rib work, spars, tips, etc., aileron, horn and struts, rigging.	Build full-size airplane.

the airplane by laying out templets, constructing jigs, building ribs, spars, ailerons, fuselage, landing gear, empennage, controls, covering, doping and painting, and building the motor mount.

The aim of this course is not to train boys to be pilots, but rather to develop skilled craftsmen, so that after graduation many will be able to find their places in the vast aircraft industry as apprentice-

As in all fields of work we find that the boys have various individual abilities, some working faster, others slower. To take care of the slow but conscientious worker, minimum requirements are set up, while the faster workers who have proved their ability, are allowed to work on a group project, such as the building of a full-size sport plane. The student's progress depends on his individual application to each successive step. In this manner both the slow and fast workers of the class are given an different ability and skill to work together as a group. In this manner the students were brought closer to industrial conditions and at the same time obtained an important lesson in cooperating with each other.

*Woodrow Wilson Vocational High School, New York, N. Y.

The young man who applies himself seriously to thinking will by and by be amazed to find out how much there is to think about.

— *Otto H. Kahn*

A Tribute to A Great Leader

WILLIAM T. BAWDEN*

A great leader has fallen! Charles Alpheus Bennett did not finish his work, for even as he was called away he was planning activities that would have occupied him for years to come.

Many persons, in widely separated spheres of activity, will be impelled to express their sense of loss, but I am sure that many years of close association make it appropriate for me to offer this tribute to the memory of a revered leader, an inspiring associate, and a long-time friend.

I am very happy to point out at the outset that Mr. Bennett had the satisfaction of knowing the high esteem in which he was held by those with whom he worked. His friends and associates did not wait until he was gone to express their appreciation of him and of his outstanding service. One memorable occasion that gave Mr. Bennett much pleasure was the luncheon in his honor at the close of the AVA convention in St. Louis in the Gold Room of the Jefferson Hotel, Saturday noon, December 3, 1938. Later, in June, 1939, Mr. Bennett presented to Bradley Polytechnic Institute his library on industrial education and related subjects, consisting of more than 1000 books and 7000 pamphlets and reports. In accepting the gift, the trustees placed his name on the Roll of Distinction of the Institute. This corresponds to the awarding of an honorary degree in other institutions.

Again, in 1939, when Mr. Bennett announced the decision to lighten the burden he was carrying by discontinuing the publication of *Industrial Education Magazine*, he received letters of appreciation from hundreds of friends and well-wishers from all over the English-speaking world. Extracts from many of these letters and telegrams were published in the final issue of the magazine, and bore eloquent testimony to the esteem in which he was held, and to the extent of the territory in which his influence was felt.

Mr. Bennett's death is an especially severe blow to members of the manual arts conference, for not only did he take the initiative in calling the first meeting and in setting up the framework and procedures which have been followed through the years; it was in these conference discussions that he so often displayed the qualities that made him the leader that he was. Further, among the members of the conference were many of his intimate friends. He will be mourned by many others as well, for he enjoyed an almost unbelievably wide circle of friends and acquaintances.

Mr. Bennett's career was unique in that he is properly classed as one of the pioneers of the industrial-education movement in America, and yet he saw many years of active leadership well beyond the pioneer stage.

St. Paul Manual Training School

When Mr. Bennett went to St. Paul, Minn., in 1887, and developed plans for the St. Paul Manual Training School, which opened one year later, only six such schools had been started in the United States: St. Louis, 1880; Chicago, 1884; Baltimore, 1884; Philadelphia, 1885; Toledo, 1885; Cincinnati, 1886; and only three of these were public schools. The organization of the St. Paul school differed from the others in significant particulars, showing originality of concept, keen analysis of conditions and problems, and constructive vision and planning. He, therefore, merits a

Charles A. Bennett

place with Dr. Woodward, Dr. Runkle, Dr. Belfield, and the other pioneers who laid the foundations of industrial education and industrial arts in this country.

Not only was the St. Paul school established at a time when the benefit of the experience of other similar schools was practically unobtainable, but it was impossible to find experienced teachers of shopwork and drafting to assist him in putting the plans into effect. It was necessary to organize a faculty for the new school by employing graduates of engineering colleges or by selecting skilled workers from industry. For both groups there had to be patient coaching in organization of instruction materials, in methods of teaching, and in an understanding of how children learn.

The solving of these and many other problems involved in organizing a school of entirely new type, with so few guiding precedents available, was an achievement in educational pioneering of first rank.

Teachers College, Columbia University

Another series of distinctive and creative achievements marked Mr. Bennett's term of service at Teachers College, Columbia University, New York City, from 1891 to 1897. Here he organized the first college department for the training of shop teachers in the United States. Among the notable *first* accomplishments of this period are:

For the first time in the United States a two-year curriculum for the preparation of special teachers of manual training was organized, thus making it possible for a student to *major* in this field.

For the first time in a curriculum for the preparation of special teachers of manual training the following *professional* courses were developed: History and Principles of Manual Training; Economics of the Planning, Equipping, Organization, and Management of Manual-Training Schools; and Observation and Practice Teaching.

The first offering for graduate credit of a course in the pedagogy of manual training, in 1896–97.

The planning and equipping of the Macy Manual Arts Building, the first of its kind at a teacher-training institution in the United States.

The first "Summer School of Manual Training" for teachers, organized and financed by the faculty of the summer school, 1896.

Bradley Polytechnic Institute

In 1897, with his removal to Peoria, Ill., began the most fruitful and constructive period of Mr. Bennett's career. His contribution to the organization and development of Bradley Polytechnic Institute was paralleled or accompanied by the founding of the *Industrial Education Magazine* in 1899, the establishment of the Manual Arts Press in 1903, the opening of the Summer School for Teachers in 1904, the organization of the Illinois Manual Arts Association in 1904, leadership in the reorganization of the Western Arts Association during the period beginning in 1904, and the organization of the Manual Arts Conference in 1909. Here is a truly remarkable record. If he had undertaken and carried through any one of these tasks in addition to the absorbing duties of his post at Bradley Polytechnic Institute, that would have attracted attention. This amazing succession of significant achievements stamps him as one of the most dynamic and productive educational leaders of the past half century.

It is impossible in brief compass to give an adequate account of his services to Bradley Institute. As head of the department of manual arts, and later dean of technology, he was the chief technical adviser in the development of a major undertaking which, like the St. Paul School and the Teachers College department, was practically without guiding precedents. Planning the curriculums; designing and equipping shops, laboratories, studios, and other facilities for instruction; designing and superintending the construction of buildings; organization of the faculty — these were some of the activities in which he took a leading part, and in which he displayed insight, originality, organizing ability, extensive knowledge, and technical skill.

His position at Bradley Institute afforded an excellent vantage point from which to observe conditions and needs, to acquire a rapidly widening circle of professional acquaintances, and to exercise the qualities of leadership with which he was endowed.

Industrial Education Magazine

While still at Columbia University Mr. Bennett became conscious of some of the special problems of the shop teacher that were not receiving adequate attention. He began thinking about the possibility of a

*Director, State Teachers College, Pittsburg, Kans.

professional journal which would aid teachers in their study of these problems. Before he could formulate a plan or carry it into effect, he moved to Illinois. Shortly thereafter he discussed the situation with a number of men, and in 1899 he launched the *Manual Training Magazine*, later changing the name to *Industrial Education Magazine*.

The launching of the magazine, another adventure upon an uncharted sea so far as our field was concerned, involved a long, hard struggle. Although there were serious financial problems, as well as editorial and publication problems, Mr. Bennett was always inclined to minimize the obstacles and worries in conversation with friends, and to dwell on the satisfaction derived from professional service rendered and the constantly extending circle of acquaintances gained.

It was indeed with the greatest reluctance and regret that he finally decided that the magazine must be discontinued in 1939. He accepted the advice of close friends, and decided not to turn it over to someone else to carry on. This point of view was very well expressed by Dr. Homer J. Smith, who was guest editor in 1938–39.

"I would rather the magazine be discontinued, when you take away your hand, than that any other disposition be made of it. Let it go, and let it stand as your project and half of your life — an extensive and important formal contribution — a sizeable, well-ordered block of the best literature we have had — an authentic and respected record, always to be prized."

And so the magazine will stand, as long as books are preserved and cherished — in public, institutional, and private libraries, all over the English-speaking world — a "five-foot shelf" of the choicest contributions of a great host of teachers, supervisors, principals, superintendents, college professors, public-spirited citizens, and others, in addition to his own writings — an unmatched treasure house of industrial education and related subjects — a monument to the memory of Charles A. Bennett.

The work on the magazine was directly responsible for a voluminous correspondence, which covered the entire United States thoroughly, and practically all parts of the world. Acquaintanceships formed in this way led to the invitation, in 1908, to visit England and the principal countries of continental Europe for an intensive study of industrial and vocational education. From this trip he brought back an immense amount of data in the form of books, bulletins, reports, photographs, and his own notes. Extensive use was made of this material in the two-volume history, in a series of illustrated articles in the magazine, in numerous addresses before meetings of teachers, and in other ways.

The Manual Arts Press

The work on the magazine also brought about the founding of The Manual Arts Press, at first to solve the problem of publishing the magazine. For the first three years, the magazine was published and distributed by the University of Chicago Press, but this arrangement proved unsatisfactory.

After a few years of experience with the magazine, Mr. Bennett conceived the idea of assembling some teaching aids that had appeared as a series of articles, and publishing them in book form. The first venture succeeded, and led to others. Through his extensive acquaintance among teachers and supervisors he was able to discover those who were doing original and worth-while things, and these he encouraged to write. Thus began the publication of a notable series of magazine discussions, textbooks, and teachers' manuals. By these means he pioneered the way, along which he was soon joined by others, and with their combined efforts he led in the creation within 40 years of an authoritative literature of manual and industrial education which has never been equalled in any other field of educational endeavor in a comparable period.

One of the most significant aspects of this phase of Mr. Bennett's leadership was his success in inspiring teachers and thinkers to put their achievements in writing to aid in advancing the cause. The whole field of industrial education is indebted to him, not only for his own personal accomplishments, but also for the contributions of a long list of those whom he inspired to productive activity.

Activities in Professional Associations

The next notable event was the invitation to a group of men to assemble at Bradley Polytechnic Institute, in February, 1904, to consider the desirability of setting up an organization that would foster and promote the teaching of shopwork and drafting in the schools. It was there and then that the Illinois Manual Arts Association was organized, probably the first state association of the kind in the United States, later to become one of the constituent parts of the Illinois Vocational Association. Incidentally, the IVA holds the record for the largest active membership in the American Vocational Association.

At the meeting in Peoria, Mr. Bennett was elected president of the new association, and I was elected secretary. Although we had exchanged correspondence previously, this was our first meeting. We worked together in this association and in other undertakings later, so that for more than 38 years we were closely associated.

Mr. Bennett was active in the Western Drawing Teachers Association, which he helped organize at the World's Columbian Exposition in Chicago, in 1893. In 1904, it was reorganized as the Western Drawing and Manual Training Teachers Association, and a few years later as the Western Arts Association. During these periods of reorganization Mr. Bennett served in various official capacities, including president, chairman of the executive council, and chairman of important committees, and in these ways rendered distinctive and constructive service.

Again, he was one of a limited group of leaders who took the initiative in organizing the Vocational Education Association of the Middle West, which held its first meeting in Chicago, in February, 1915. In enthusiasm, attendance, and influence, the annual meetings rivaled those of the old National Society for the Promotion of Industrial Education, and of its successor (in 1918), the National Society for Vocational Education. As president and as chairman of important committees, Mr. Bennett rendered conspicuous service during these years, as well as in the negotiations which led to the merger, and the inauguration of the American Vocational Association, in 1926.

Only those who shared the responsibilities of leadership and direction of these and other professional organizations of teachers are competent to evaluate the distinguished and indispensable services rendered by Mr. Bennett through the years. He has a genius for organization, and unsurpassed facility in stimulating the efforts of others.

The Manual Arts Conference

The story of the origin of the Manual Arts Conference has been told, and need not be repeated here. Only two of the twelve men who attended the first meeting are now active in the conference. Even with a changing and expanding membership, the original plan of organization still functions, practically without change. Only a plan of genuine merit and vitality could survive more than 30 years, as this plan has.

To members of the conference who knew Mr. Bennett, who sat with him at the conference table and recall his penetrating comments and incisive analysis, who remember his sympathetic attention to the contributions of others and his openness to new ideas, the invariable modesty with which he put forward his own suggestions, who knew his friendly greeting and solicitous interest — I need say no more. We cherish sacred memories of a genial friend and inspiring leader, that belong particularly to this association.

History of Manual and Industrial Education

One of the crowning achievements of a busy life, in which I know Mr. Bennett took great personal satisfaction, is the *History of Manual and Industrial Education*, the first volume of which was published in 1926, and the second in 1937. No one else could have written this work. It stands unique.

Three factors account for Mr. Bennett's unusual qualifications for this task: (1) a voluminous correspondence with educational leaders, who were able to keep him informed on the progress of events, and particularly to aid in interpreting the significance of developments; (2) the industrial education tour of Great Britain and the Continent, from which he brought back a wealth of firsthand information and source material; and (3) systematic visits to more than a score of the important libraries of the United States and Europe in search of material bearing on the historical phases of industrial education.

In treasuring the two volumes of the *History*, we shall always recognize our indebtedness to a lifetime of study and research, beginning with the offering in 1891 of the first college course in the history of manual training, continuing through the years, and interrupted from time to time only by the pressing demands of other important projects.

Biographical Sketch

Charles Alpheus Bennett was born on a farm near Holden, Mass., on March 28, 1864, and died at his home in Peoria, Ill., on June 17, 1942, in his 79th year.

For the past six or eight years, Mr. and Mrs. Bennett spent at least a portion of each winter in Dunedin, Fla. They were attracted to this locality because Mr. and Mrs. William E. Roberts had acquired a home there after the former's retirement. Mr. and Mrs. Frank M. Leavitt were in near-by St. Petersburg, and other friends were not far away. This year the Bennetts remained in Florida longer than usual. Mrs. Bennett had been in poor health during the winter, and they did not

(Continued on page 320)

Problems and Projects

SHAPER VISE

WILLIAM A. DE VETTE

Technical High School
Erie, Pa.

(See assembly and details on pages 302 and 303)

The vise, in some form or other, seems to be a never ending source of project material for the school drafting room and shops. The shaper vise submitted herewith is in the form of a drafting-room project.

As in the case of a number of previous projects the shaper vise is offered on the premise that a complete project which may be built and used in the school shops and then put to use has a much greater teaching value than a number of unrelated exercises for which the student can see no immediate or future use. Much related information can be included, during the development of the drawings, which will be of immense value to the drafting student.

A project such as the shaper vise may be routed through the school drafting room, the pattern shop, the foundry if one is available, and the machine shop. Upon completion it will be found to be a valuable piece of shop equipment.

The shaper vise is not a difficult drafting project and may be given to first-year trade students or to regular high school students for detailing and tracing, and for assembly drawing.

The vise may be machined by the day trade students in the shop or may be made by the toolmaking classes operated under the National War Production Training Program.

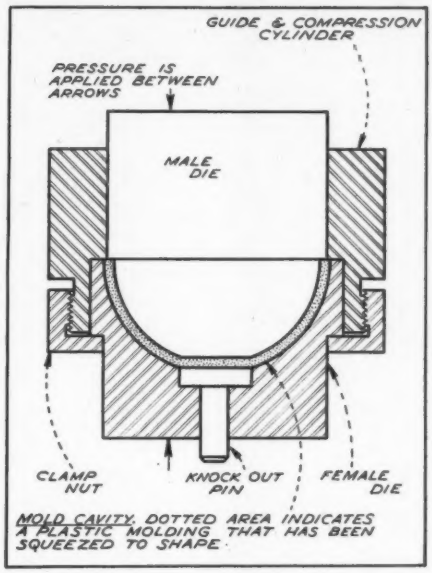

GUIDE & COMPRESSION CYLINDER
PRESSURE IS APPLIED BETWEEN ARROWS
MALE DIE
CLAMP NUT
KNOCK OUT PIN
FEMALE DIE
MOLD CAVITY, DOTTED AREA INDICATES A PLASTIC MOLDING THAT HAS BEEN SQUEEZED TO SHAPE

Fig. 1. Cross section of the hemispherical molding dies made of machine steel

MOLDING PLASTICS IN HIGH SCHOOL

DALE PETERSON

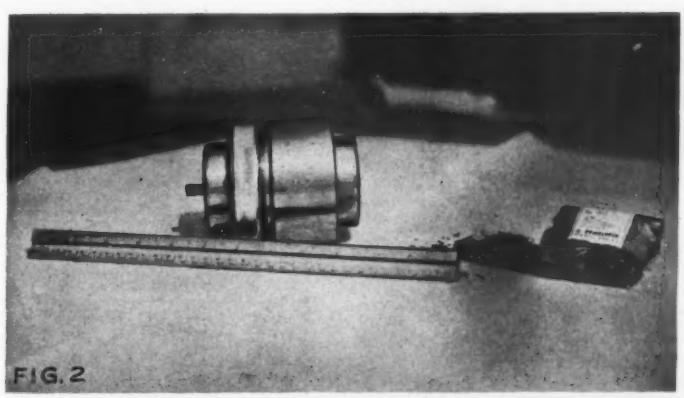
Formerly Teacher of Woodwork and Hobbies
Irving High School
Salt Lake City, Utah. Now in the U. S. Army

To most teachers of industrial arts the word "plastics" has a rather restricted meaning. To them it vaguely includes articles or materials made of celluloid or celluloid-like substances for which they do not know the correct, identifying names. In this, however, they are not alone for most people today take what they call "plastics" quite largely for granted, and while they show much curiosity in regard to these materials, they know little about them.

The current war and the war production program is causing this interest in plastics to become very great. This is due to the increasing number of uses to which plastics are being put in the mad rush to find substitutes for the needed metals. Here most plastics find ready adaptation to the same uses to which the metals have been put. Their lightness of weight, high strength ratios, ease of shaping and forming, and resistance to chemical actions (oxidation by air or attack by water, acids, or alkalis) make them good substitutes. In addition they are usually very good electrical insulators — a quality not possessed by the metals. Their beautiful appearance when colored by pigments or dyes and their sparkling clarity is more than skin deep and makes their usage unlimited as to variety.

At the present time a few teachers of industrial arts have, with varying degrees of success, incorporated an instructional area in plastics within their shops or laboratories. Considering the great use that is made by the consuming public of plastic goods in comparison to the consumption of wood and metal goods, there is need for more instruction in regard to plastics. This is true if this material is to occupy the rightful place in the school curriculum that it has earned in the public markets.

Even those schools that do offer work in this new field, give only instruction and experience with the type of plastic materials called *cast resins*. These resins or plastics are on the market in the form of sheets, rods, tubes, squares, and some other ornamental and figuline shapes. School projects are made by sawing, bending, carving, etc., these cast forms to desired shapes and then fastening the component parts together to make the completed project. Now, in industry, this type of plastic work produces but a small proportion of the world's plastic articles.



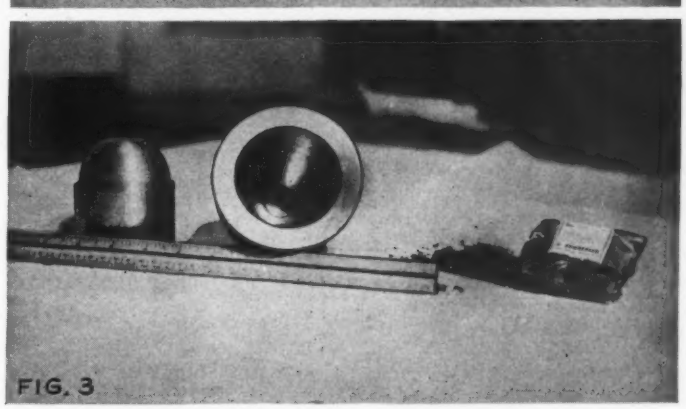
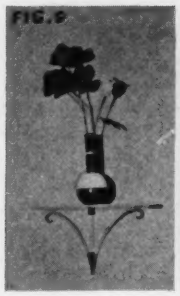


Fig. 2. Molding dies assembled. Molding powder at right. Scale in foreground shows relative size. Fig. 3. Molding dies partly assembled, but open to show mold cavity and knockout punch in bottom

Pen stand molded in hemispherical dies

Clip jar and lid molded in hemispherical dies

Tiny bon bon dish molded from Vinylite



Flower vase and transparent wall shelf

Table lamp from old phonograph records

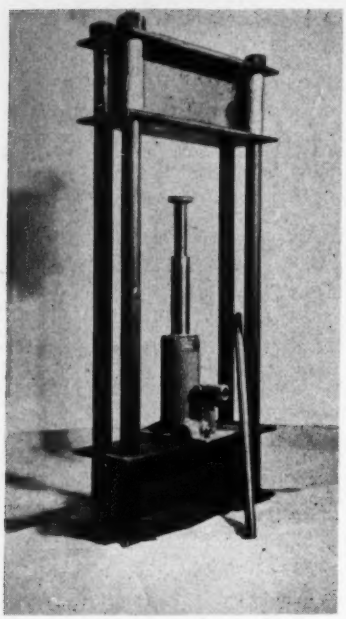


Fig. 4. The press

Fig. 11. Transparent goblet from plexiglass

By far the greater majority of commercial articles are made by molding, under heat and pressure, the desired article or its component parts. These parts are formed from ground plastic granules called *molding powders*. These molding powders are sold on the open market by many firms. At the present time, however, due to the war production needs, it is necessary to use reground powders that are made from scrap parts of other castings, so that the original molding powders may be used for war work.

The powders are placed in heated dies which have been formed and polished to the desired shape. The powders are then subjected to high pressure. Under the influence of pressure the heat-softened plastic powder *flows* together and into the cavities of the mold to form a properly bonded article. The molds or dies are then partially cooled and the plastic article is ejected or expelled from the die. This molded article needs little or no (none in most cases) polishing for the polished die-mold has given it a very lustrous surface.

Such molding operations can be carried on

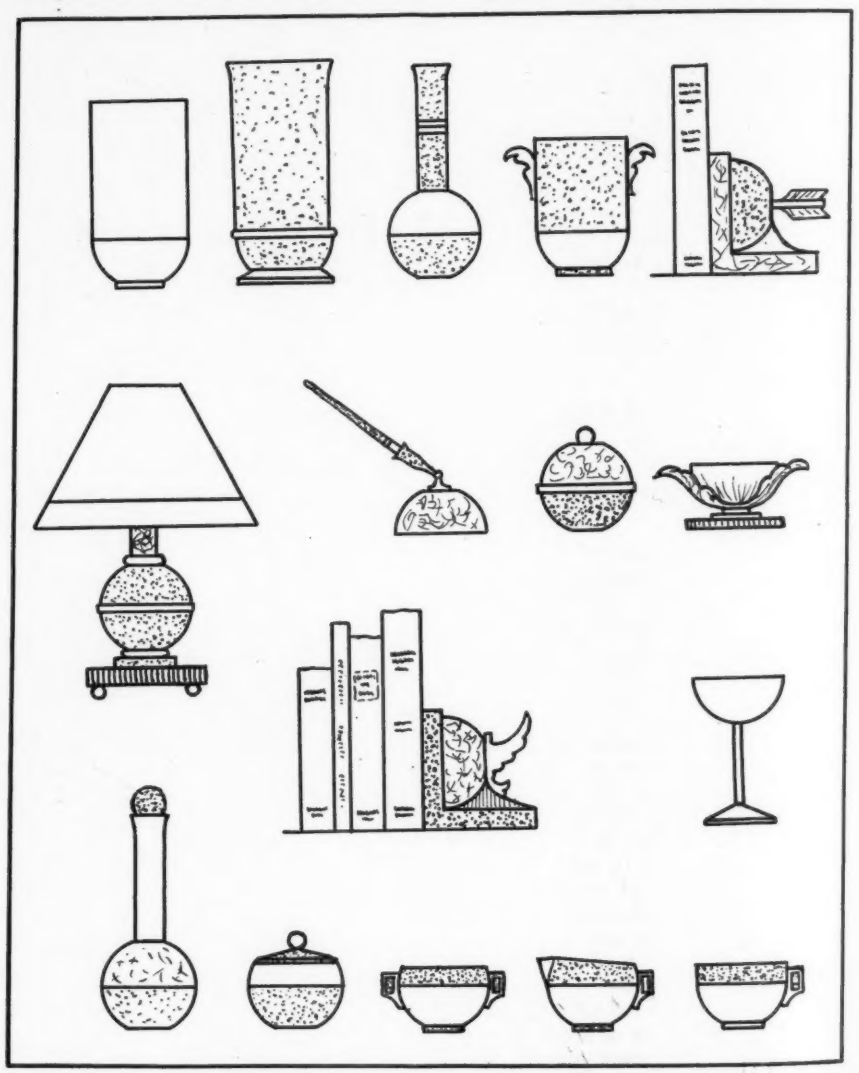


Fig. 5. A small portion of the large group of projects that may be made with a single hemispherical molding die

in a small school shop without the addition of much equipment. Most of the equipment can be made from scrap and castaway materials. The remainder can easily be purchased at a small cost. The returns in education will many times overpay a school board for this expenditure. After all, it is their specific duty to see that their schools educate the pupils for the present and for the future. Who will deny the great place that plastics now occupy or have in store in the near future? Who also will deny the need that future citizens must be experienced to varying degrees with the composition and utilization of this medium?

Through a course in *Reading and Conference* (a graduate course in industrial arts) at the Oregon State College, Corvallis, Ore., some equipment has been developed and operated by the author for the molding of plastic articles on a scale that could be transplanted to other school shops. Materials for making the hydraulic press were selected with a view toward those items that might be found in scrap or junk yards. The dies used were also chosen for their adaptability to a great variety of small projects and for their simplicity in construction and operation.

The accompanying illustrations show the general nature of the press, molds, and possible projects. These illustrations are from detailed instructions that have been developed in regard to making the press, molds, and projects. The unit operations involved in molding with this equipment also are described. The operations are essentially the same as those used in industry. The means of overcoming the difficulties to be found in working with the new materials have been described, whether it be for the acetates, vinyls, methacrylates, or styrenes. The lowly phonograph record (a shellac molding compound) has contributed its bit as an inexpensive material for molding. Certain recommendations why molding of the nitrates, ureas, and phenolics should not be undertaken have also been given.

In addition to the straight molding of plastic articles, much work has been done and described for extruding and platen pressing of plastic powders. Extruding dies and platens that may easily be made have been developed. From them many stock shapes as sheets and rods can be made from the molding powders. These shapes are much cheaper than those that can be purchased, and a much greater variety of straight and mixed colors may be obtained. The cast shapes of the commercial type have proved their value, however, in many projects.

It is hoped that this investigation will provide the stimulus to put this new area into the school shops of the nation!

A MECHANICAL-DRAWING TEACHING DEVICE

TRABER W. KERLEY

Northeast Junior High School
Kansas City, Mo.

Any one who teaches beginning drawing knows how difficult it is to get some of his students to see a pictorial drawing or model transformed into a two- or three-view drawing, with space left between views for dimensions, and the whole thing centered on a sheet of paper.

The device described herewith has been used for some time. It rates very highly as an aid in teaching students to visualize the finished drawing.

When shown Figure 1, the student can readily answer his own question as to how a certain view is to be drawn because this teaching device shows him the position of the views, the space between the views, all visible edges, where the edges are that are invisible, why the end and top views are the same width, etc. It also shows why the end view does not show any length; the top view, any heights; and the front view, any width. The location of a given point in either of the views is also made easy.

This teaching device is of special help to the boy, who, instead of keeping the model or object in a fixed position, and moving his body so that he can look at the different views, turns the object about, thereby getting it completely out of position with reference to the views as they are to be seen on the completed drawing. This device can be turned into any position and still have all of the views in their proper relation.

One of these teaching aids, made for each of the first three or four orthographic drawings, gives the pupils a good start on visualization which is so important in drafting.

BATTERY CARBONS FOR WELDING AND CUTTING

D. C. MARSHALL

Manhattan, Kans.

Learning to get along without many things that we have been used to in the past, is going to be a big job, but it can be done. In the field of welding, rods for the small shop are unobtainable unless one has a priority rating, and gas for the gas cutting and welding equipment is almost as hard to get. There is one thing that one can get for electric welding that will make a very efficient substitute and that is the carbon rods out of old dry cells and flashlight batteries.

Unless one has a lot of heavy cutting to do, a carbon rod in the arc welder will cut through heavy sheet and light bar stock about as fast as a gas cutting torch would, and certainly it is much cheaper. The rod works best if it is pointed to help narrow the arc to a small area.

Top illustration shows how battery carbon is clamped in the rod holder. The wire for welding is held in the left hand. Bottom shows a butt weld where it was necessary to fill a hole in the edge of the break. The unwelded portion shows how small a V is needed on this type of work

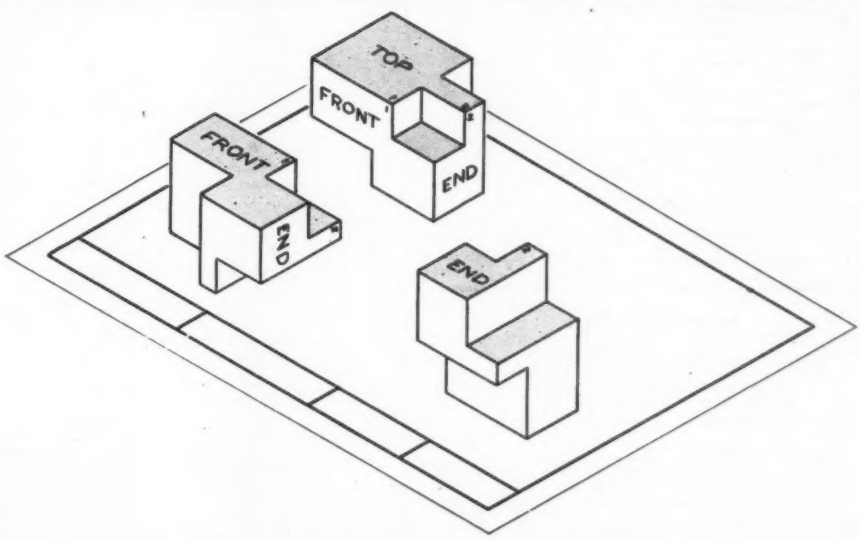


Fig. 1. Visual aid for teaching orthographic projection

This can be done on an ordinary grinder, and the metal post on the top of the carbon makes a good contact when gripped in the rod holder of the arc welder.

Welding can be done with anything from a piece of wire to scraps of metal. With a piece of wire in one hand and the carbon rod in the holder in the other hand, welding can be done in the same manner as when using a gas torch. For filling holes or welding narrow stock, a piece of metal can be laid over the hole and flowed in, or a scrap may be laid in the V to be welded and melted to make a strong joint.

The small rods from flashlight cells work as well as the larger ones but do not last nearly so long, although they may be used in places where the larger rods would be too cumbersome.

PERSONALITY CHART

GEORGE BRITTAIN
High School
Johnson City, N. Y.

The form shown herewith has been found very useful in keeping a record of the personality traits of the students in the classroom, and for giving prospective employers some indication of the general disposition of graduates whom they may want to employ.

Industrial Arts Dept. Shop _____

Name _____ Date _____

Rating period 6 weeks

Personality Traits	Dates when rated														
	Very Poor	Poor	Average	Good	Superior	Very Poor	Poor	Average	Good	Superior	Very Poor	Poor	Average	Good	Superior
Appearance-Neatness															
Courtesy-Manners															
Accuracy-att. to detail															
Interest															
Industriousness															
Leadership-Popularity															
Co-operation															
Dependability															
Disposition-Temperament															
Natural Ability															
Initiative															
Workmanship															

Remarks: _____

Personality chart

PUSH STICKS FOR JOINTER AND TABLE SAW

G. L. SIMNICHT
Folwell School
Minneapolis, Minn.

The jointer is one of the more dangerous machines in the woodworking shop. Therefore, it is the duty of every woodworking teacher to make this machine as safe as possible for himself and for the students.

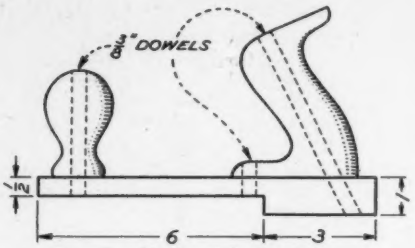


Fig. 1. Push stick for jointer

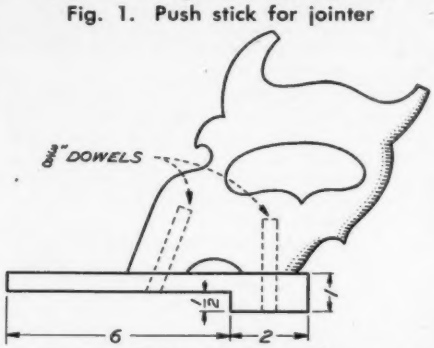


Fig. 2. Push stick for table saw

The push stick shown herewith has been found safe, convenient, and easy and comfortable to use.

It is made from the handle and knob of a discarded plane. These two parts are glued and doweled to a hardwood base as shown in the drawing. The pusher may be painted red so that it attracts the attention of the user. The stick should be in sight of and handy to the user at all times.

Table saws also should be equipped with push sticks. The one shown in Figure 2 has been found satisfactory because it fits the hand and there is little danger of slipping. This type of push stick is made from a discarded handsaw handle. The handle must be planed flat where it is doweled to the base. The angle at which the handle is fastened to the base may vary according to the individual user. The handle and the base are joined with glue and 3/8-in. dowels.

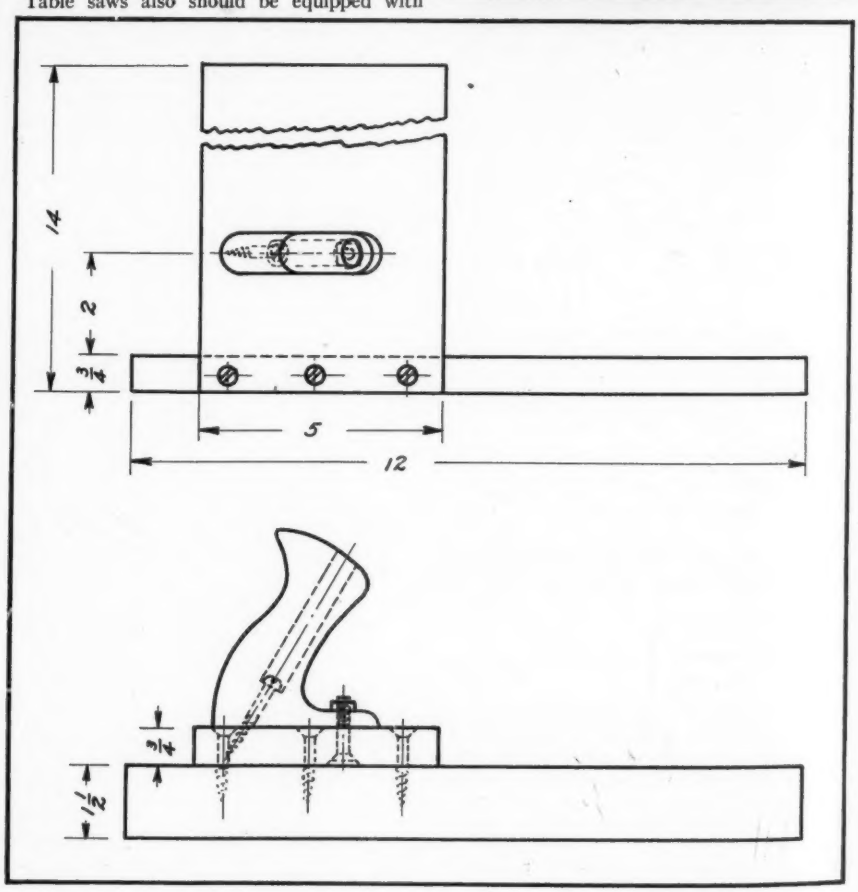
This push stick also should be painted red.

BAND SAW CUTOFF FENCE

LEE ARNOLD
Industrial Arts High School
Grand Haven, Mich.

Very few band saws are equipped with any accessories for cutoff work. At times it is convenient to have a cutoff fence, especially in a school shop where classes are large and the universal saw is in constant use.

The fence described herewith consists of two pieces of 3/4-in. plywood or solid maple —



in fact any wood that does not warp easily — and one jack-plane handle for Bailey No. 5 plane. The hole in the handle may be counterbored to make use of a shorter screw.

Care must be exercised when assembling, for glue and screws must be used to insure a solid, square, permanent construction.

MODEL AIRPLANES AT SODDY-DAISY

JOHN W. DEAN

High School
Soddy, Tenn.

This article is written in anticipation of a request from the navy for more scale model airplanes from the school shops when they reopen in September since the plans and patterns for the *B* and *C* groups arrived too late for many of them to be completed before the schools closed in June.

The work on the planes of the *A* group was done under rather unusual conditions and circumstances in the Soddy-Daisy High School shop. The third instructor of the year arrived early in February and found the shops quite devoid of lumber or other materials; not even a nail or screw nor a can of glue could be found. For a rural high school, located on the main highway between two villages, it had been well supplied with power machinery, but only the spindle shaper was left in good condition. There were no blades for the band saw, and its wheels were out of alignment and their rubber coverings were loose. All the blades for the circular saw were dull. The superannuated planer was equipped with knives that were not only misfits, but dull and nicked almost beyond rehabilitation. The 6-in. jointer had a bent axle, and its knives were dull. One lathe had a broken switch and one of the tool-rest supports was missing; the other lathe lacked a plug on the connecting cord.

No inventory of the shop was to be found, and there was no record of materials or expenditures, and no trace of the shop fees that had been collected from the boys at the beginning of the year to care for overhead expenses.

Finally, two oversize band-saw blades were obtained, and a new supply of first-class lumber was ordered from the county seat. About this time the request for making the model planes arrived, and a quota of 90 planes was assigned to our school.

The large general chart and the individual assembly sheets for each plane were mounted on a piece of ⅜-in. plywood which was set up on a large workbench. On the bench, in front of this, were 20 large pasteboard boxes, clearly numbered for each of the 20 models of the *A* group.

But the school had no PTA and the boys flatly refused to pay any more and get nothing for their work, so such of the new lumber as was suitable for planes was donated to the cause, since its normal sale was so definitely checked. A week was spent reading and discussing the booklets on construction procedure — the instructor reading and demonstrating for the freshmen who insisted (and proved) that they were unable to read or understand the big words used in the text. They proved it repeatedly after the actual work was begun.

In the meantime the mechanical-drawing class had already made tissue tracings of each sheet of patterns and templates in case any of them might be lost. Then a duplicate set of templates was cut from red pressboard to save wear on the originals. Large envelopes, also labeled and numbered, were provided for the pieces of each sheet and were kept in the proper box. The remainder of the pattern sheets were also preserved for reference.

One boy volunteered to check and sort the more than 500 pattern pieces each day. He reported only one piece missing at the end of the school year, and was presented with a handmade Victory medal, designed by the instructor, for his faithful service.

At first, progress was extremely slow, but a number of jigs and fixtures were made which were a great help to not only finish our quota, but add a few extra to that number.

For instance, for sawing out the fuselage shapes on the band saw, the instructor first

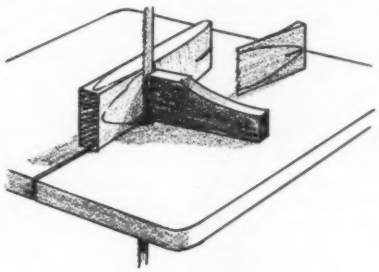


Fig. 1. Pusher stick in use

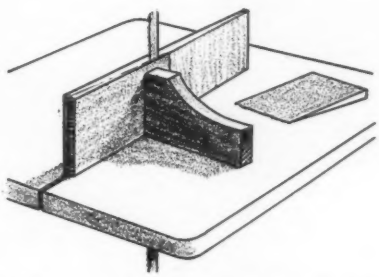


Fig. 2. Band sawing the wings

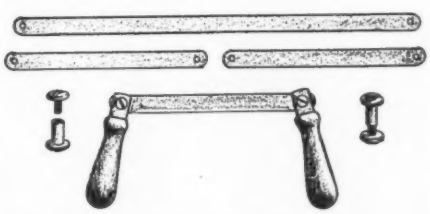


Fig. 3. Small drawknives made from old hack-saw blades

cut out the top pattern, and then the side after the waste sidepieces had been tacked back with ½-in. nails. A convenient aid in the first sawing was the pusher stick shown in Figures 1 and 2. This was made square on one end and about as wide as the stock of the fuselage. With this stick the stock was held exactly upright. It also held the saw blade against the stock when it cut out on the side, for we were forced to use a great deal of ⅞-in. wood where a full 1-in. thickness would have been better. It was found advantageous, frequently, to leave a couple of inches of stock on the front end of the sawn fuselage in order that it might be held in a vise or by the hand while whittling.

We were unable to obtain any of the small model-maker's drawknives or planes; hence, made substitutes from old hack-saw blades as shown in Figure 3. These were practical, however, only when extra stock had been retained for clamping. In general, the long bladed jackknife was the preferred tool. A few wood-carving gouges from the instructor's personal kit aided greatly in shaping narrow cabins on broader bodies. We did not try turning any of the round-front fuselages on the lathe, but this might have been done on at least part of them, if an inch or two of stock had been left at each end.

The fuselages of *A*–13 and *A*–18 were made from 1⅞-in. stock. These needed a ⅛-in. slit through the tail. Uniform blocks were cut for each model and the location of the slot found from the side pattern. The circular saw was then set to the proper depth, the fence adjusted, and the slit made while the block was held upright. Time was saved by cutting all of these pieces with the same setup. A single cut on the band saw sufficed for the 1/16-in. slit on the smaller planes and this could be widened by a second cut when 3/32-in. slits were called for.

Following the instructions given, we tried planing the taper of the wing strips with smooth planes but found that our vises would not hold the boards securely enough. Then we tried band-sawing the taper by marking it on one edge and using a square-ended guide to keep it from tipping, as shown in Figure 2. But this proved to be too slow; hence the adjustable jig shown in Figure 4 was devised for use with the circular saw. It consists of a strip of 9/16-in. cypress about 3¾ in. wide and 24 in. long for the main part of the jig. A strip of the same thickness 1 in. wide and 3½ in. long was nailed securely near the back end to act as a stop for the wing strips. This piece is marked *S* in Figure 4. Another piece of the same size, but chamfered a little on the back edge, was tacked at *T*, near the front end. This piece must be adjusted back or forward as necessary, for the taper of each wing. For example, the wing of model *A*–7 is to be left 9/16 in. thick at the middle and to

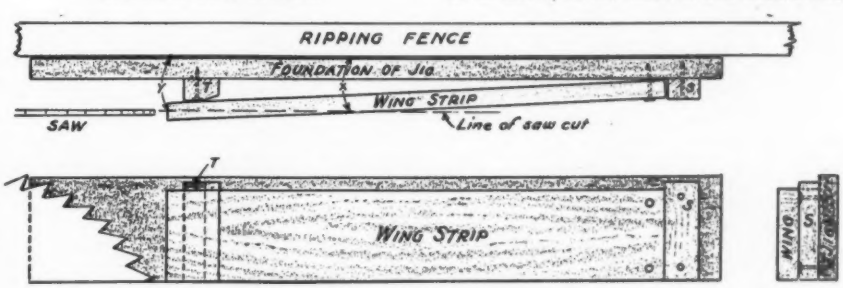


Fig. 4. Tapering wings on the circular saw

be tapered to 3/16 in. at the ends. Therefore, a strip 9/16 by 3⅜ by 19 in. would be placed on the jig with one end against the stop *S* and the other on the strip *T*. The middle would be marked in pencil on one side and the 3/16-in. thickness scribed on each end. Then a small pair of dividers would be set to span the space from the ripping fence over the jig and to the middle line of the wing. Next, it would be tested for similarity to the distance over the jig plus the 3/16 in. at the end on the strip *T*. This strip would then be moved forward or back until the distances *X* and *Y* would be equal. See top view, Figure 4. Of course, it was usually necessary to change the setting of the dividers since both *X* and *Y* change when *T* is moved.

When they were equal, *T* was tacked in place, and to prevent any possible slipping, the wing strip was also held at *S* with two small nails, and block *T* was adjusted until the saw would slice off a wedge-shaped piece and barely leave the middle line. The nails in the wing strip would then be withdrawn, and the wing strip turned end-for-end, the thin end nailed at *S*, and the other end would be tapered. Once the proper setting was found much time was saved by tapering all of the wings for the *A*–7 models at one time. Several of the boys soon learned to perform the whole operation and it was only necessary to mark the correct location of *T* on the jig for each of the planes mentioned and no further measurements would be necessary in order to taper additional wings.

Wings for model *A*–6 required ⅜-in. stock so the 9/16-in. wood was first ripped to thickness and the slice of thin wood kept for parts of smaller planes. Some of the wedge-shaped pieces were saved for rudders, while the rest were trimmed a little on the thin end and ripped into strips ¾ to 1 in. wide and used for stirring paint or spreading glue.

A smaller jig was made for cutting the wings and stabilizers for the planes of lesser size. The tough, thin sticks from ice-cream bars furnished very satisfactory wood for most of the tiny tailwheels.

The problem of obtaining the correct angles on the wings was solved by making a sanding disk and table. An octagonal board ⅞ in. thick and as wide as a sheet of sandpaper was fastened to the faceplate of one of the lathes, from which the tailstock had been removed. See Figure 5. A sheet of sandpaper was squared and the four corners stapled to the board as shown.

The basis for a tilting table was a piece of ⅜ by 10 by 12-in. plywood, supported on the edge next to the wheel by a beveled edge-board at just the height of the center of the disk.

This upright support was nailed to a base which was just as wide as the lathe bed and as long as the tilting table plus the distance to the head of the lathe, so neither it nor the table top could be forced against the disk. No hinges happened to be available, hence two holes were drilled close to the edge of the plywood top and widened on the underside so the top could swing or tilt up or down on two finish nails driven down through the holes into the beveled top of the support below. See Figure 5. The top was held down on these nails by two screen-door springs as shown.

Two lengthwise cleats under the table provided for two pivoted slotted upright supports sliding up or down on ¼-in. carriage bolts fitted with large washers and wing nuts. Two rabbeted blocks were suspended on the heads of ¼-in. carriage bolts under the base, as shown in Figures 5 and 6, for holding the contrivance securely to the lathe bed.

At first we calculated the dihedral angle from the gauge and a trysquare with a T bevel, transferring this angle to the tilting table and marking the location on the supports below. Then we found it much simpler to set the table at 90 deg., and substitute a strip of wood for the dihedral gauge under the wing tip and thus the wings, cut apart on the band saw, were given the correct angle with barely a touch on the rotating disk. Probably too much was sanded off some of the wings for, with one or two cuts and two or four sandings, the wing top was considerably shorter than the original pattern.

The sanding disk was used for many other things but was not found to be very satisfactory for any other than edge or end sanding of plane parts so we made a sanding drum for the other lathe — just a solid cylinder of wood about 12 in. long and 10 in. in circumference. A ⅜ in. groove was cut along one side with the dado head in which to tack the ends of a sheet of sandpaper. This was only a makeshift but served very well for some work. Its greatest drawback was that, if the wood to be sanded were held on the top, the dust would be thrown directly on the operator. To hold it underneath meant that the tool rest had to be removed. The difficulty was partially overcome by making a two-bladed fan to screw onto the outer screw of the headstock. The blades were sanded to shape on the disk sander. They were so shaped, that the dust would be blown toward the work. It was found that at the higher speeds, this contrivance worked quite well.

As most of the nacelles were round, or nearly so, we found that they could be turned on the lathe more accurately and more quickly than they could be whittled, for 18 or 19 out of the 50 models. Most of them could well be turned from ⅞ in. square stock in pairs, as shown in Figure 7, leaving enough square stock at each end to be held in a vise, on the sander, or the band saw for special shaping.

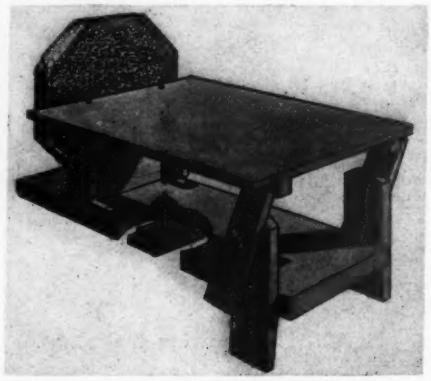


Fig. 6. Perspective drawing of the sanding apparatus

Fig. 7. A pair of nacelles turned on the lathe

We found it a real saving of time to turn out the small landing wheels in series, to be sliced off with a coping saw as needed. A survey of the assembly sheets shows wheels are to be used on models *A*–5, 13, 17, *B*–1, 4, 9, 18, 19, and *C*–3. In most of these, a single disk is to be split to form the two half-wheels needed. It is only necessary to turn short sections of a long strip to the proper diameters (Fig. 8) and to shape the required number of "beads" of the designated thickness. A half dozen ⅛ in. thick would use only an inch of material, allowing space between for sawing apart. Here, again, the square stock at each end would aid in holding it steady in the vise or on the saw table. Since they are too small to be marked, time and confusion would be saved by cutting them all apart immediately and storing them in small envelopes, properly

Fig. 8. Series of landing wheels turned out in series

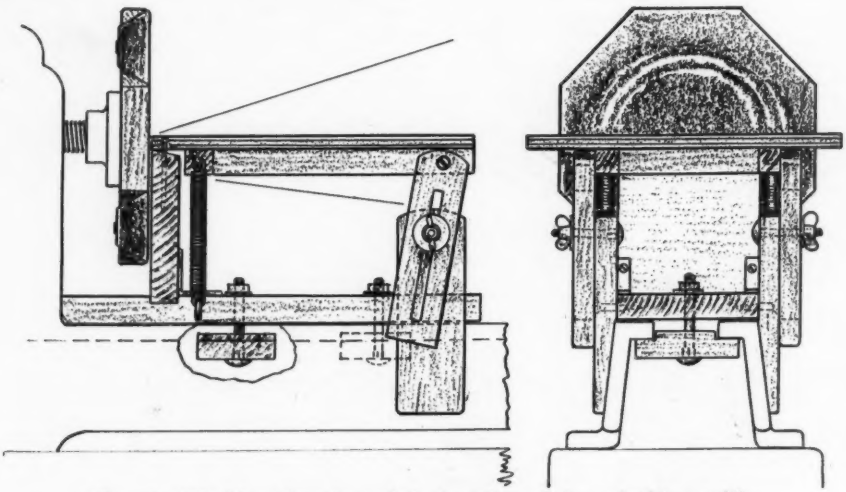


Fig. 5. Working drawing of the sanding disk and tilting table

labeled for each model, until they were needed.

Small accessories, such as spinners and the tailpiece of A-13 were easily made from dowels partially shaped in the pencil sharpener and then smoothed to the correct form before cutting them off. The same procedure was applied to the making of small floats.

We were unable to find dowels less than ¼ in. in diameter, though the specifications called for ⅛, 3/32, and 1/16 in. sizes. Our lathe had no chuck to hold small strips but an old breast drill did have. So we clamped the drill upright in a metal vise, placed a slender square strip of straight grained wood in the chuck, folded a piece of sandpaper about it and turned the handle. This produced fairly round dowels of approximately the right size for struts, made of the same kind of wood as the rest of the plane. See Figure 9.

We used a great many tubes of airplane cement for assembling, but later found Casco glue quite dependable, though slower in setting. Casco glue mixed with the finely powdered dust from the disk sander to a fairly dry mixture, was used as a wood putty. It dried quickly and made a good strong joint. It was allowed to dry semihard, then pressed or whittled to a very smooth finish and sanded when dry.

We found no aids to speed the routine work of shaping and assembling, except experience. Boys who had spent several weeks in making their first model found they could make the

Fig. 9. Sanding small dowels with a breast drill

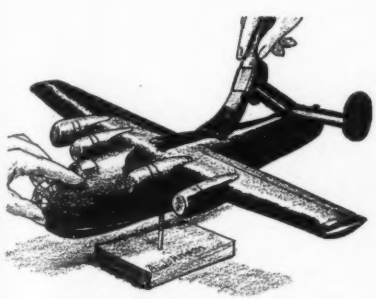


Fig. 10. A support for painting and drying

second one in as many days, and a third one in half that time. Seven specified models, entitling the maker to the rank of lieutenant, was the highest number completed by any one boy, but he also put the finishing touches on three planes for one of his classmates, critically ill in the hospital, in order that he might receive his ensign's rank during his crisis.

The making of these planes was a helpful experience to most of the boys who participated. If we are called upon again for the remaining 30 models many of the boys will be well prepared to handle the more difficult ones without assistance, though they will probably prefer to use mass-production methods — one in a group making fuselages, one making wings, etc., and all cooperating in assembling. No doubt they would learn more by working separately but they have already had that experience and are ready for the great lesson that it is teamwork, speed, and specialization that "keeps them flying."

GRINDING NIB ON DRILL BIT

R. W. E. BOWERS

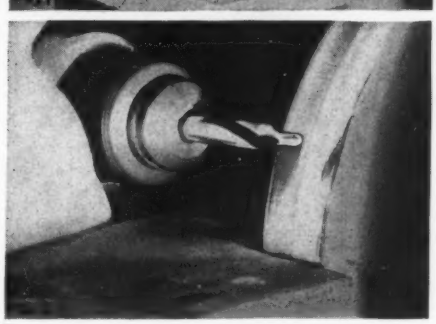
High School
Ottawa, Kans.

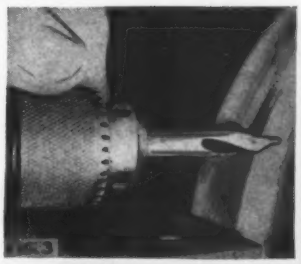
Many shops use small twist drill bits for boring in wood. They shift with the grain of the wood because they lack a nib. By following the method described herewith it is easy to grind a nib on a twist drill bit.

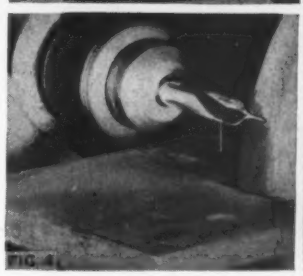
Operation

1. Insert the drill bit in an electric hand drill.
2. With the grinding stone turning, start the drill and place against the stone, as shown in Figure 1.
3. Keep the drill revolving until the drill has been ground to a point as shown in Figures 2 and 3.
4. Stop revolving the electric hand drill, and grind a sharp edge on the drill bit, as shown in Figure 4. The bit, Figure 5, can be used in mechanical drill, hand brace, or hand drill.

Be careful not to grind a curved face on the cutting edge of the bit. This edge should be straight. It will be found that the drill ground







as directed in the foregoing, will put a straight hole through any type of wood, and will not shift with the grain of the wood.

DECIMAL EQUIVALENTS

NORMAN W. MORGAN

Technical High School
Scranton, Pa.

Each fractional part of an inch has its corresponding decimal equivalent. The decimal equivalent of any fractional part of any inch may be easily obtained by adding or subtracting a minor fraction from a major fraction.

It is necessary to memorize the major and minor fractions.

Major Fractions	*Minor Fractions*
⅞ = .875	1/16 = .0625
¾ = .750	1/32 = .03125
⅝ = .625	1/64 = .015626
½ = .500	3/64 = .046875
⅜ = .375	
¼ = .250	
⅛ = .125	

Example: Find the decimal equivalent of 21/32. The nearest major is ⅝ (20/32) .625. Add to this the minor 1/32 (.03125) and the result is .65625.

Example: Find the decimal equivalent of 19/32. The nearest major is ⅝ (20/32) .625. Subtract from this 1/32 (.03125) and the result is .09375. Note that it is never more than 1/16, 1/32, 1/64 plus or minus a major fraction, except you may have 3/64.

Example: Find the decimal equivalent of 51/64. The nearest major is ¾ (48/64) .750. Add to this the minor 3/64 (.046875) and the result is .796875.

REDUCING SLEEVES — OPERATION DRAWING

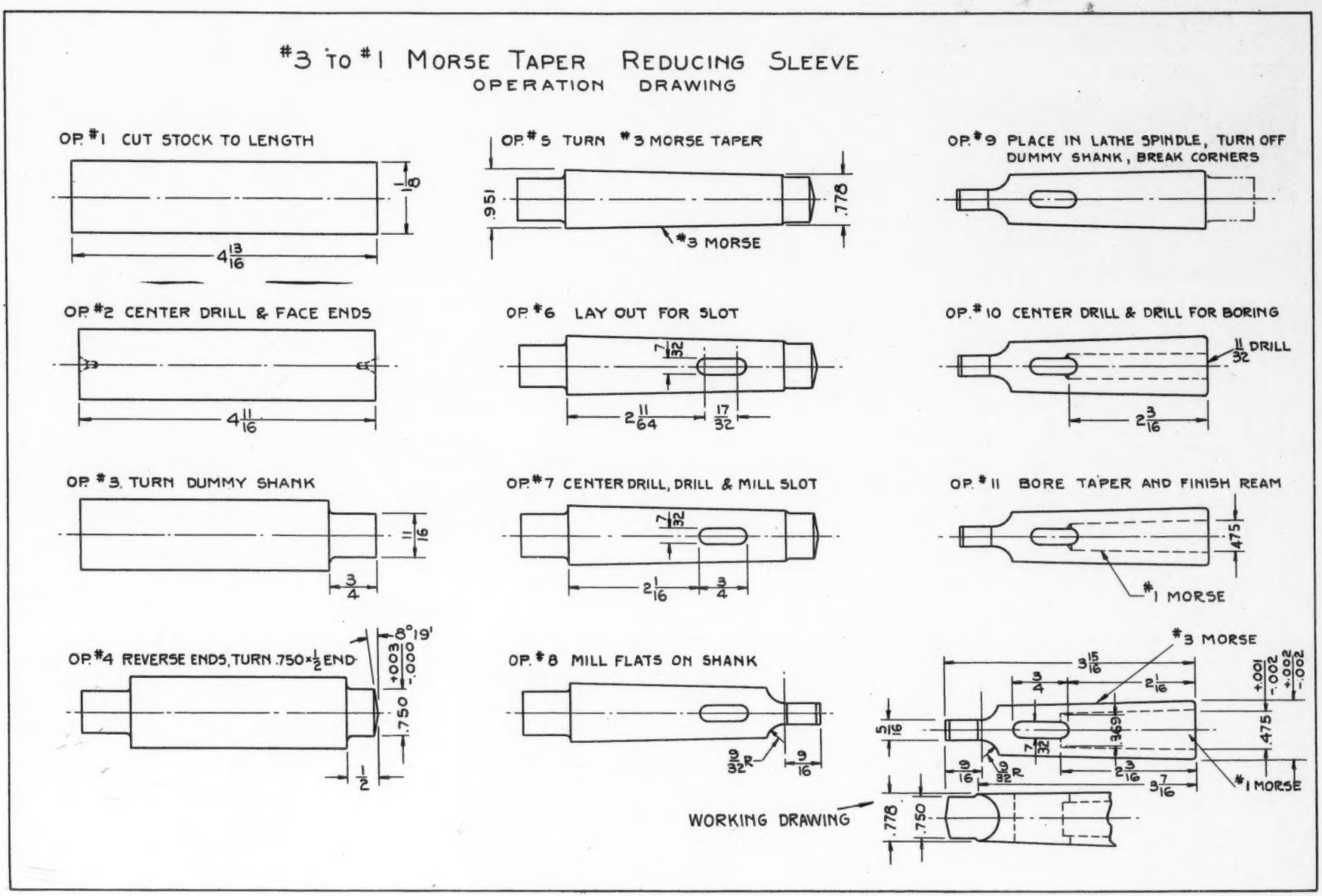
WILLIAM A. DE VETTE

Technical High School
Erie, Pa.

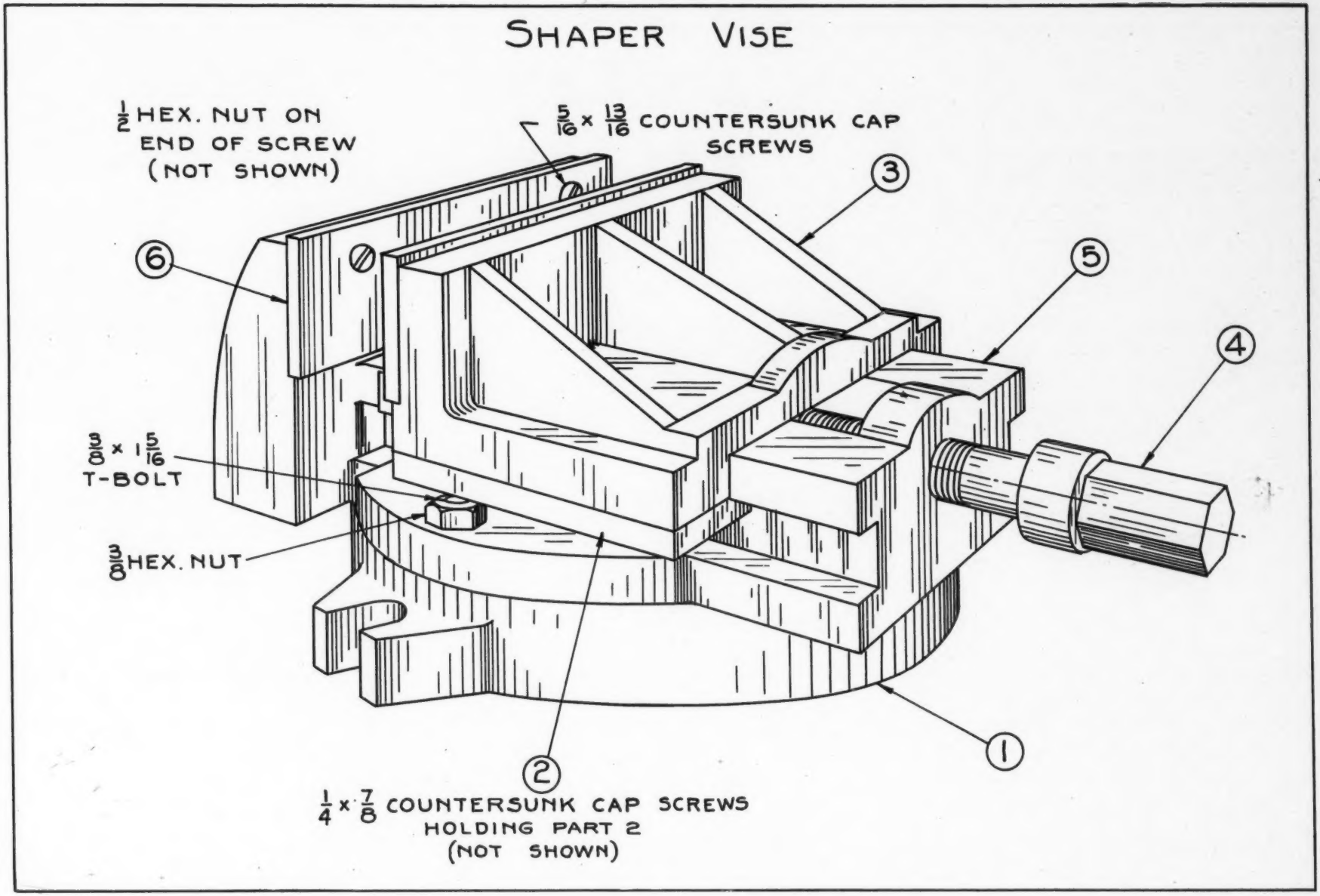
The operation drawing for the No. 3 to No. 1 Morse Taper reducing sleeve is another in a series of projects for the machine shop.

The reason for this series of projects was explained in detail on page 260 of the June, 1942, issue of this magazine, and no space

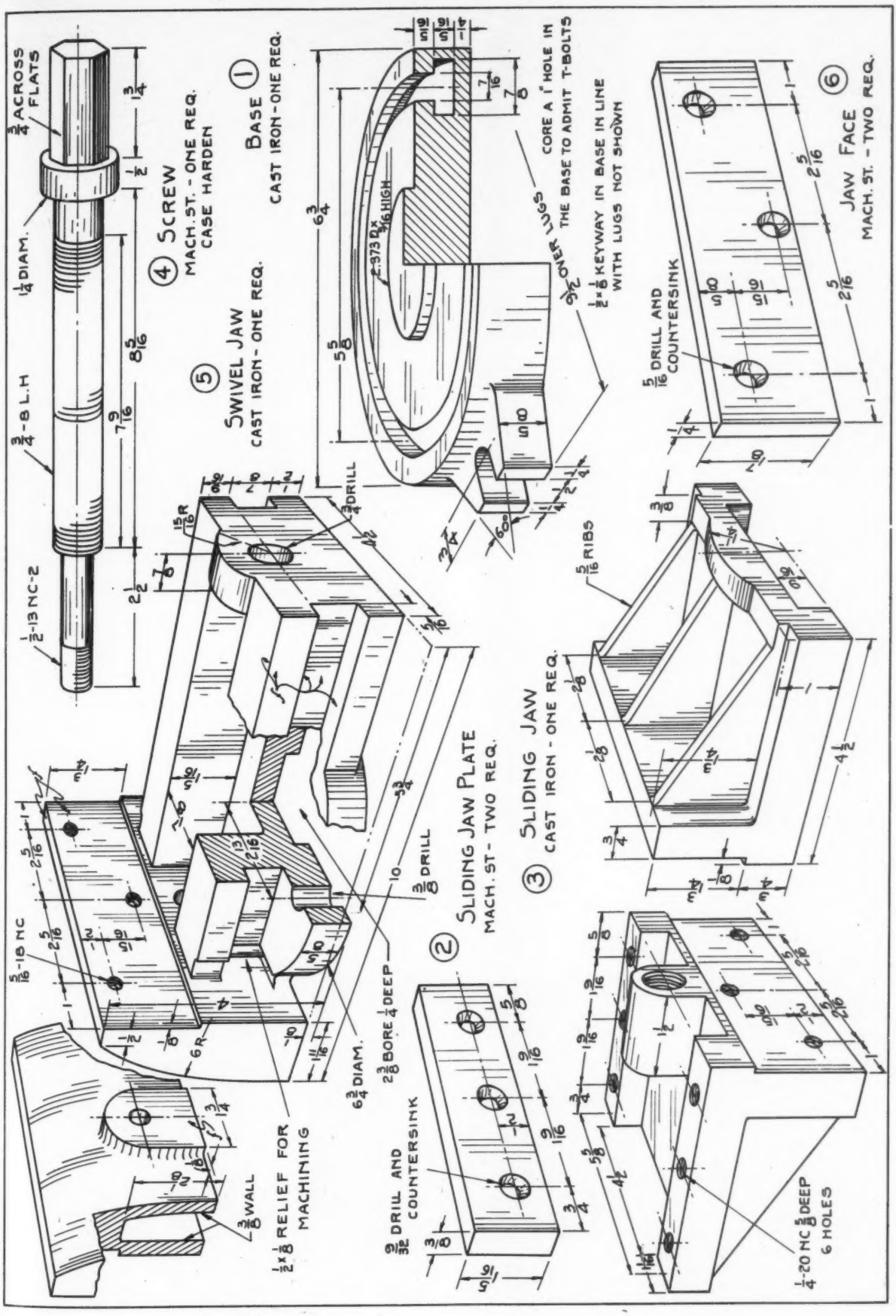
(Continued on page 305)


#3 TO #1 MORSE TAPER REDUCING SLEEVE
OPERATION DRAWING
OP. #1 CUT STOCK TO LENGTH
OP. #2 CENTER DRILL & FACE ENDS
OP. #3 TURN DUMMY SHANK
OP. #4 REVERSE ENDS, TURN .750 × ½ END
OP. #5 TURN #3 MORSE TAPER
OP. #6 LAY OUT FOR SLOT
OP. #7 CENTER DRILL, DRILL & MILL SLOT
OP. #8 MILL FLATS ON SHANK
OP. #9 PLACE IN LATHE SPINDLE, TURN OFF DUMMY SHANK, BREAK CORNERS
OP. #10 CENTER DRILL & DRILL FOR BORING
OP. #11 BORE TAPER AND FINISH REAM
#3 MORSE
#1 MORSE
WORKING DRAWING

Operation drawing for machining reducing sleeves — William A. De Vette



Shaper vise assembly by William A. De Vette, Instructor, Technical High School, Erie, Pa.
(For description see page 293)



Shaper vise assembly by William A. De Vette, Instructor, Technical High School, Erie, Pa.

(For description see page 293)

(Continued from page 299)

need be given in the present issue for the explanation of its use.

This project, as others previously offered, was designed with the following specific ideas in mind as regards a good project for the machine shop: sound teaching procedure, a maximum number of operations with a minimum expenditure of material, and usefulness of the project after completion.

CEMENTED CARBIDE TOOLS IN A SCHOOL MACHINE SHOP

MILO P. JOHNSON

Vocational Machine Shop Instructor
California Polytechnic School
San Luis Obispo, Calif.

Cemented carbide cutters have practically revolutionized a large portion of the machining operations that are carried on in modern industry. The pressure of speed in the war production program has added to their use

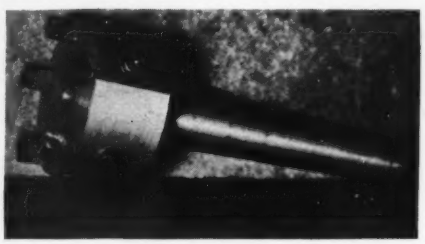


Fig. 1. Cemented carbide inserted tooth milling cutter

until now it is practically imperative that those who train boys and men to operate machine tools must include a thorough unit on the use and care of carbide tools.

Carbide tools can be operated from two to six times faster than high-speed tool steel. The old machinist who used carbon or high-speed tools could generally tell whether the work was going fast enough by the appearance or feel of the machine. He probably never worked the feet-per-minute formula because for him it was comparatively easy to tell the

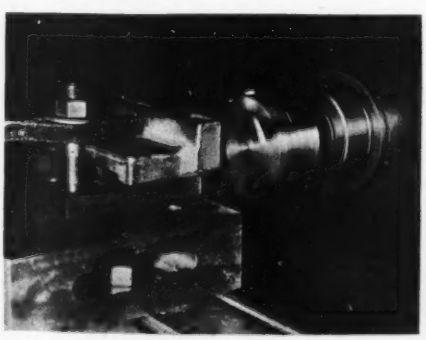


Fig. 2. Facing vise jaw with a carbide head

difference between 70 and 90 f.p.m. But there are few who can guess speeds of 180 to 600 f.p.m., at which carbides operate. With this new emphasis on higher speed the formula for figuring the cutting speed in feet per minute, the use of tables concerning proper speeds and feeds, and the relative toughness, hardness, and abrasiveness of materials ma-

Fig. 3. End milling a recess for the carbide tip

chined must all receive more attention than were formerly given them by the instructors and students.

Instructors in school shops often have to combat worn-out equipment and feel that the use of carbide tools is not practical. To use these tools to their maximum requires as much as 50 per cent more horsepower for the machine than was formerly required for high-speed tools. If possible, new motors with greater horsepower should be purchased for the heavy-duty lathes; their motors moved down to the medium lathes and so on. If there is no money available for new electric motors there are still many jobs on which carbide tools can be used. The oldest lathe will generally pull more than a high-speed tool will take when cutting cast iron. Even in a bench lathe there are situations where these tools come in handy. The torch-cut surface, scale on small steel or iron castings, bakelite and other small, difficult-to-machine objects can be turned at high speeds and light feeds on most bench lathes.

An inserted tooth milling cutter, like the one shown in Figure 1 can be made as a shop project and then used for facing work at speeds up to 300 f.p.m. Figure 2 shows such a milling cutter at work on cast iron.

The cost of carbide tools is the one thing in our general economy that has decreased in price in the past year. Due to their wide acceptance they are now being manufactured

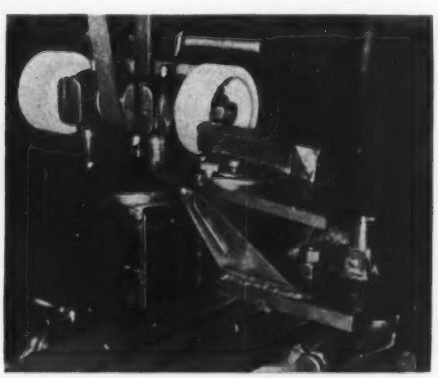


Fig. 4. Special table on a tool and cutter grinder used for grinding carbide tools at the correct angle

on a mass-production basis with its consequent savings. The three methods of purchasing carbide cutters are: finished tools ready to be used, which can be bought either full sized or in small sizes made to fit a special holder; semifinished tools that only need to be ground; and the carbide tips only, which must be brazed into machined shanks. For the school shop the latter method is the most inexpensive and has the greatest educational value. All the large manufacturers of carbide tips will furnish on request catalogs and price lists of their products. The author has found that a fairly large tip, ¼ by 5/16 by ⅝ in., works the best. A rigid long-lived cutter can be made by mounting this tip on a low carbon tool steel shank whose dimensions are ½ by 1¼ by 6 in. This tool should be made in both right- and left-hand types and is usable in lathes up to 18-in. swing. The method of mounting one of these tips in a holder might be likened to the inlaying of a piece of wood. A portion of the shank is milled away so that the tip will just fit into the cutaway part. Figure 3 shows such a shank being milled. The procedure of brazing the tip to the shank is not difficult and it may be done with an acetylene torch or a small furnace.

In ordering tips one should take into consideration the quantity discount. The price of a tip bought singly may be almost twice as much as the same tip if bought five at a time. One should also be sure to specify the grade of tip desired. The grade number designates the relative hardness of the tip desired. The harder the tip the longer it will wear but the more likely it will be to crack and chip. If there is any question in the instructor's mind as to what grade he should order, it would be best to specify the material to be cut and let the vender choose the proper tip grade.

The grinding of carbide tools is a subject about which a great deal has been written and said. Each manufacturer has his own method of grinding the tools; they furnish charts and prints which fully describe the grinding of their carbide cutters. Figure 4 shows a tool and cutter grinder rigged up to sharpen carbide tools. Notice the shop-made tilting table which enables the students to get the proper grinding angle. On one side of the grinder is the roughing wheel, a 60-grit soft bond silicon carbide wheel; on the other side which is reached by revolving the universal table through 180 deg., is a 120-grit wheel which puts the finish on the tool. If a tool is being ground for the cutting of steel then the vise should be mounted on the grinder table and a 1/64 in. deep by ⅛ in. wide groove ground for the tip breaker. By the utilization of the universal grinder with an inexpensively built tilting table no new equipment will be necessary to begin the use of carbide tools in a school shop.

If our methods of teaching machine-shop practice are to keep in step with modern industry we probably will be using almost nothing but carbide tools in the near future.

PAINTING WITH FLOWER JUICES

MAY LILLIAN LAMPE
Weehauken, N. J.

Some interesting experiments have been made by Mrs. Ruby Warren Newby, a member of Universal Handicrafts, Rockefeller Center, New York, on painting with flower juices. Her attention was drawn to this method of coloring by two children who were

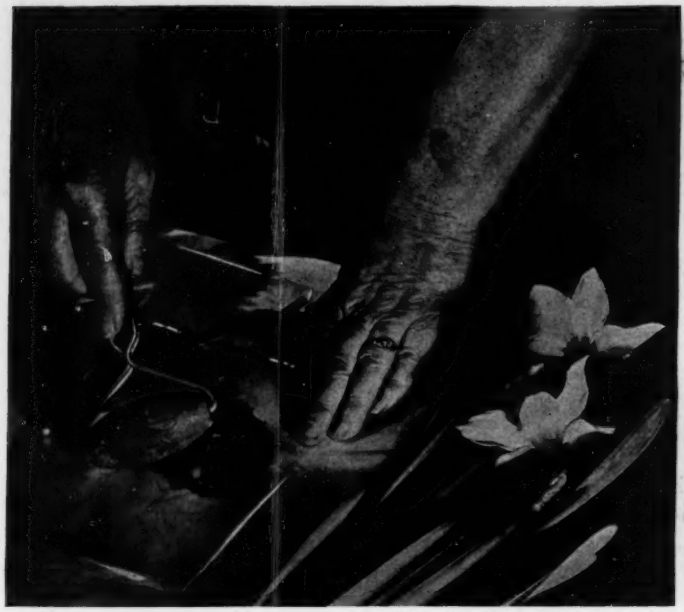


Fig. 1. Using the roller over the cellophane thus crushing the juices of the flower or leaves into the paper

Fig. 2. Mrs. Newby retouching after the design has been produced with the stencil

staining paper with the juices of flowers and leaves.

Her experiments have shown that these juices produce color effects similar to those seen in ancient Chinese prints and paintings; that the colors can be used on paper and fabrics, and that they become quite permanent when certain mordants are used.

The method used is as follows: after having made the design a stencil is cut. Occasionally multiple stencils are made so that masses are established by one stencil and details by another. Colors may also be overlapped so that the juices from two or three different brilliant flowers may produce varying effects. The stencil is laid on the mordant treated paper, and then the colors are pressed through the open spaces, either by rubbing the petals or leaves with the finger tips, or by using a roller on the cellophane laid over petals, as shown in Figure 1.

After the colors have been applied through the stencil or stencils, a little retouching with ink or colors will bring out the more salient features of the design. See Figure 2.

STRETCHERS FOR AN EMERGENCY

HARRY G. CLARKE

High School
San Leandro, Calif.

The average industrial-arts shop has little opportunity to give boys work under the conditions they will meet when they leave school. This is especially true of repetitive work with a trade value. Too often such jobs as we do get become immediately monotonous, and the work lags because it is just work.

Recently we were given an order for 300 folding stretchers for the American Red Cross. They had to be exact because they were a part of an order for one thousand, divided among four high schools. The need was immediate, so time for delivery was short.

How to make it interesting and instructive, and yet meet the deadline? This job called for hundreds of pieces milled exactly, close to 2000 hinges put on just right, 14,000 screws to be driven by hand. And in the final assembly most of the screws had to be taken out, the previously sewed canvas put in place and stretched, and the parts put back together.

Repetition? Plenty! Five groups of seven boys each day, 45 working minutes to a group and six short weeks for delivery.

Monotonous? Not a bit! We worked out an assembly line, complete down to the last inspector. Each group had a foreman who ran the show. These five boys met with the instructor, figured the job in all its phases, and designed and constructed the jigs necessary for the various steps of assembly. They estimated the space needed for each operation, the order in which the jigs should be placed, and even made racks for storage to keep the canvas clean until delivery. Most of this was

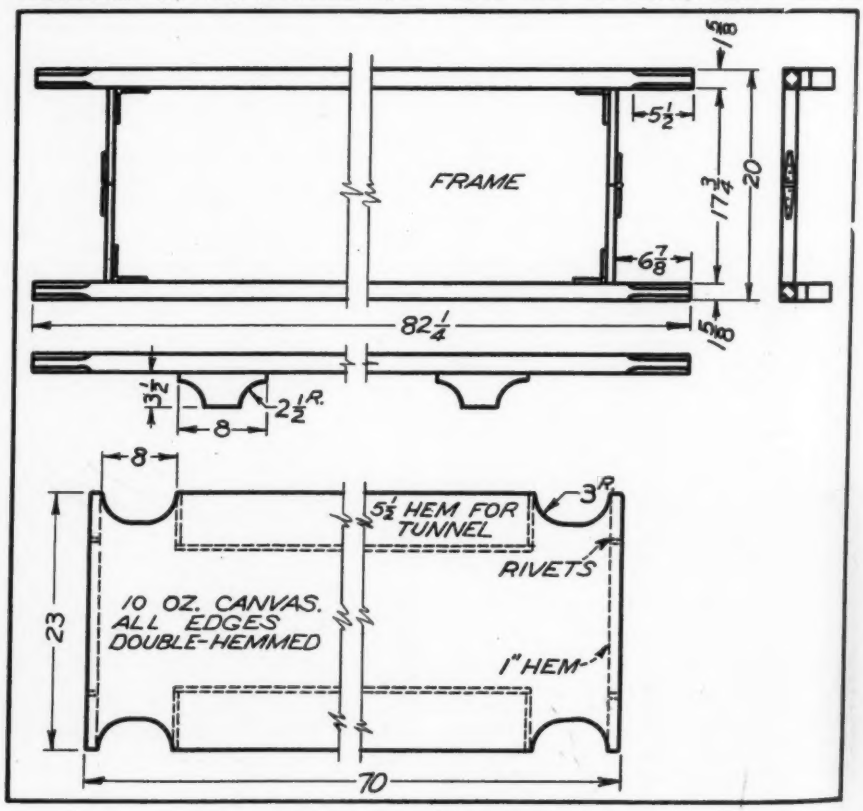


Fig. 1. Assembly and details of stretcher

Fig. 2. Drilling the legs

done before the lumber was received from the lumberyard.

Getting the millwork done was the easiest part, for boys love to run the machines. However, there were drawbacks even to that. The shop could not be turned over entirely to this one job as the group working on it was but one third of the class. The other two thirds were still working on their own projects and provision had to be made for them to keep busy. It was necessary to exercise great care in checking the setups before each group started. A single mistake would throw the whole assembly line out of order later. In addition, the machines had to be cleared twice a week for an evening class of adults.

The lumber was straight grained 2 by 4-in. fir for the handles and legs, and 1 by 4-in. spruce for the spreaders.

In brief, the millwork problem was this: 600 sidepieces: 1⅝ by 1⅝ by 82¼ in., surfaced to exact thickness, one edge jointed straight, ripped to 1 11/16; the sawed edge of remainder jointed and ripped. Rough edge surfaced to square. Cut to exact length on table saw, ends square.

Octagon Hand Grips: The ends of the sidepieces were cut octagon, 5½ in. on the jointer. Fir splits easily, so the cuts could not be made in the regular manner. Both tables of the jointer were lowered, the fence set at 45 and built up to clear the knives, a stop-block clamped on and the stock lowered and cut from the back table. The sharp edges of the entire piece were then knocked off on the jointer set to one sixteenth, and the ends rounded on the disk sander.

Thirteen thousand two hundred machine operations. Count 'em!

Twelve hundred Legs, 1⅝ by 3½ by 8 in., ripped to width, cut to length on the table saw, marked for curve from pattern, band-sawed, drilled, and countersunk for screws in a jig on the drill press. These holes had to be exact so legs could be interchangeable. The curves were then sanded on an especially made drum sander on the lathe.

Fig. 5. Completing frame

Fig. 3. Jig for placing legs

Fig. 4. Jig for spacing hinges on spreaders

Fourteen thousand four hundred machine operations.

One Thousand Two Hundred Spreader Parts, ¾ by 1½ by 8⅞ in., surfaced, ripped to width and cut to length on table saw, and rough edge jointed to exactly 1½ in. After the others, this was easy, although greater care had to be taken to have all sizes exact. If the width was not right, the piece would not fit the jig for hinges; if the length was off the canvas would either be loose or torn.

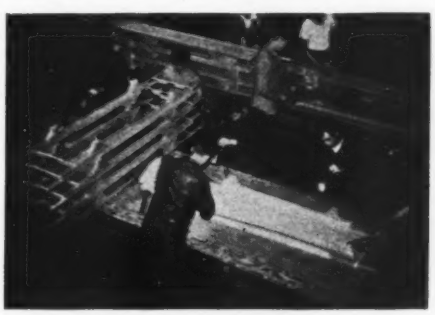


Fig. 6. Assembly line

Fig. 7. Some finished stretchers and boys who made them

A simple mill job but — 6000 machine operations.

Assembly: With the exception of the final operation, this was done entirely with jigs made for the purpose. These jigs, designed and tested by the boys themselves, spaced the hinges on the spreaders; placed the legs on the sidepieces the proper distance from the handles to fasten the canvas through the hem; and put the assembled spreaders directly under the end hem of the canvas.

An interesting test was suggested and made; we put aside the first, the last, and one other completed stretcher and interchanged each part down to the last screw. It was one of the biggest lessons in the value of accuracy I have ever been able to put over to my boys.

A side light that was most interesting, but which was not mentioned and probably not thought of by the boys, was the fact that one of the foremen was a Japanese. He was an excellent worker and a stickler for detail, and he did a fine job. The order for evacuation of his countrymen from our area came in the middle of our work. He said to me that day, "I sure hope I don't have to go till this is finished!" He had the honor of driving the last screw.

This was not the biggest job we have undertaken in our little shop, but it was the most interesting. The motivation of the war effort, the challenge to ingenuity, the assembly line idea, and the intense rivalry between the five groups kept monotony away and made repetition a pleasure.

Oh, yes! We finished just five days and two hours ahead of schedule.

SYNCHRONOUS MOTOR

JOSEPH J. LUKOWITZ
Milwaukee, Wis.

This elementary synchronous motor is simple in construction and economical in the use of materials of construction. It requires no brushes, no commutator, and no windings on the rotor. The r.p.m. can be calculated by dividing the alternations of the current per minute by the number of spokes or poles in the rotor. For 60-cycle current and a six-spoke rotor the calculation is: 7200 divided by 6, or 1200 r.p.m.

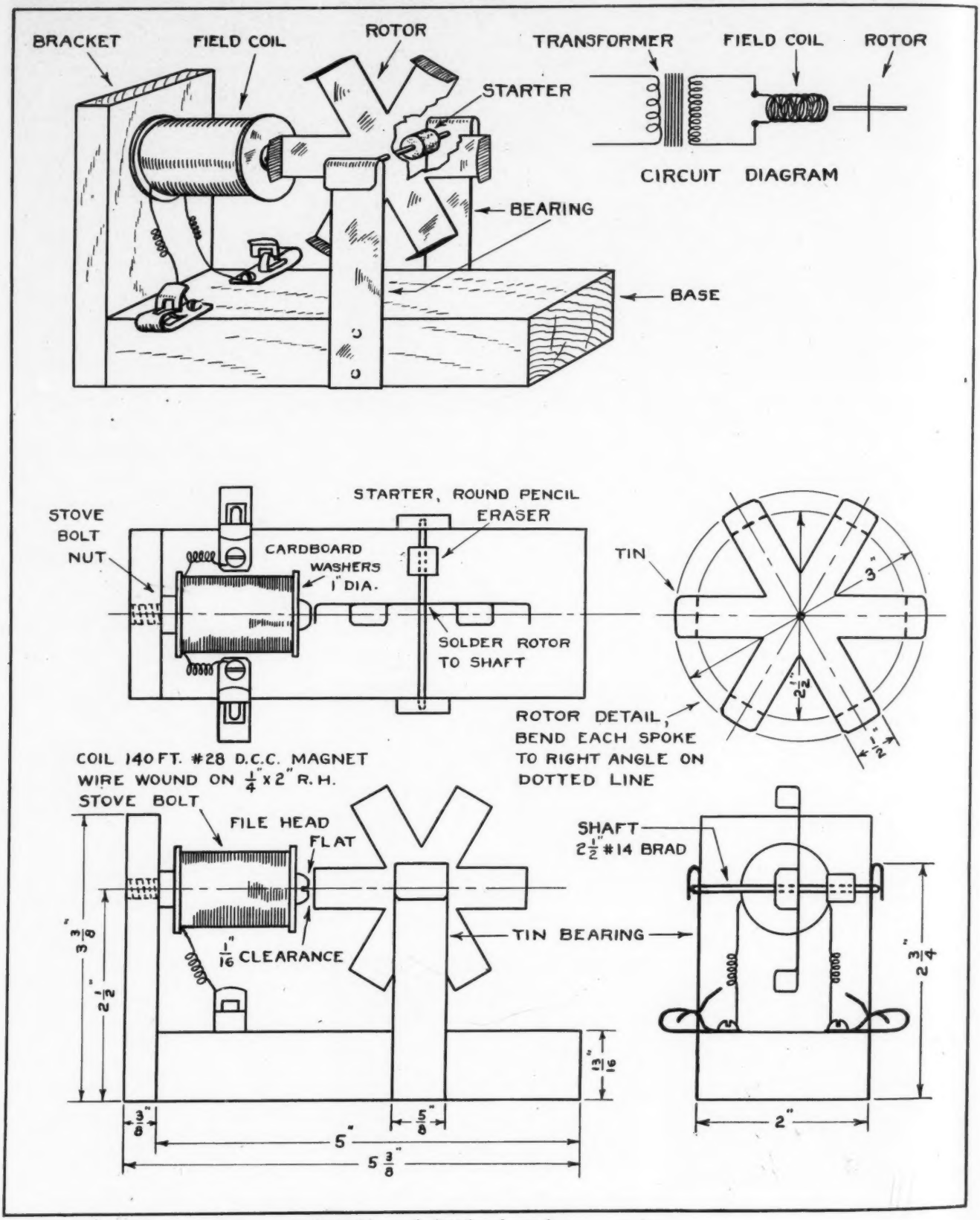
Boys are very much interested in this motor and the instructor can demonstrate why the motor will not run on direct current. An eight-pole rotor may also be constructed to illustrate how the number of poles affects the speed. An eight-pole rotor will have a speed of 900 r.p.m. The difference in speed of the six-pole and the eight-pole rotor is readily discernible to the pupils.

Materials Required

No. Required	*Name*	*Material*	*Size*
1	Wood base		13/16 x 2 x 5⅜ in.
1	Wood bracket		⅜ x 2 x 3⅜ in.
1	Tin rotor	Salvage from tin can	3-in. diameter
2	Bearings	Salvage from tin can	⅝ x 3⅜ in.
1	Shaft		No. 14 by 2½-in. brad
1	Coil core		¼ x 2-in. stove bolt and nut
2	Coil ends	Cardboard washers	1-in. diameter
1	Coil	No. 28 d.c.c. Magnet wire	140 ft.
1	Starter	Round pencil eraser	
2	Terminals	Fahnestock clips	

Plan of Procedure

1. Cut base and bracket to size.
2. Drill 3/16-in. hole in bracket for the stove bolt.
3. Nail bracket to base.
4. Stain or shellac base and bracket.
5. Make cardboard washers and punch 3/16-in. hole in washers.
6. Place washers on bolt and space properly. Place nut on bolt.
7. Insulate bolt between washers with tape or paper glued on bolt.



Assembly and details of synchronous motor

8. Wind coil by placing bolt in hand drill or bench drill.

9. Attach coil to bracket.

10. Fasten clips in position and connect coil ends to clips.

11. Cut bearings and punch hole for shaft. Bend top end of bearings over to take thrust of shaft.

12. Lay out rotor very accurately with dividers and straight edge. Enameled tin will make the layout clearer.

13. Punch hole in exact center of rotor and carefully bend spokes as shown in illustration.

14. With pliers cut head and point off 2½-in. brad. File ends of brad round and remove any roughness from brad with file and emery cloth.

15. Hold or clamp bearings in position on base.

16. Slip shaft through rotor and put shaft into bearings.

17. Slide rotor on shaft so that it lines up with the head of the bolt as shown by drawing.

18. Solder rotor to the shaft. Be sure the face of the rotor is square with the shaft.

19. Drive a 16d nail through a round pencil eraser and withdraw the nail. Push the eraser on the shaft.

20. Adjust the bearings so that the rotor has a clearance of about 1/16 in. as shown by the drawing. Fasten bearings permanently to the base with 1-in. flathead nails.

Operation of Motor

Connect the coil to an 8- or 10-volt transformer and revolve the rotor by means of the starter. Increase the speed until the rotor is brought up to a speed of 1200 r.p.m. When this speed is reached the rotor will continue to revolve because it will be synchronized with the alternations of the 60-cycle current which produce the on and off impulses of the magnet. When the rotor is revolving at a speed of 1200 r.p.m. each spoke is in turn attracted by the magnet but when the spokes reach the magnet the magnetic attraction is very weak and the rotor coasts until another spoke approaches the magnet. Then the alternation of the current in turn produces a strong magnet and another spoke is attracted. This succession of attractions keeps the rotor revolving at a fixed speed. The motor will continue to run as long as the circuit is closed and as long as nothing retards the speed of the rotor.

A small drop of very light oil should be placed on each bearing. Revolving the motor at too high a speed and then allowing it to slow down does not start the motor. Spin the rotor by trial and error until the correct speed is obtained.

A common household application of the synchronous motor is the electric clock which must necessarily run at a fixed speed.

INTERESTING CALCULATION METHODS

JAMES McCORMAC

Weber College
Ogden, Utah

The following trick multiplications may not be so very important, but they do create interest and attention.

To Square Any Number Ending in 5

Example No. 1: Find the square of 25.
Solution:

Step 1. Write out the problem as shown in Figure 1.

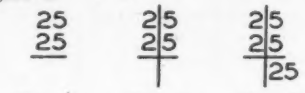


Fig. 1 Fig. 2 Fig. 3

Step 2. Draw a vertical line, separating the 5's from the rest of the numbers as shown in Figure 2.

Step 3. Multiply 5 × 5 and place the result beneath the horizontal line as shown in Figure 3.

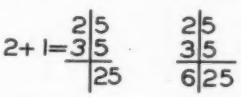


Fig. 4 Fig. 5

Step 4. Add 1 to the lower number which is to the left of the vertical line. See Figure 4.

Step 5. Multiply the two numbers found on the left of the vertical line and place the answer beneath the horizontal line, as shown in Figure 5. The total result (625) is the square of 25.

Example No. 2: Find the square of 65.
Solution:

Taking all of the steps, but shortening the process, one can write the problem at once as shown in Figure 6. By making the multiplications as indicated in the solution of the example, it is found that the square of 65 is 4225.

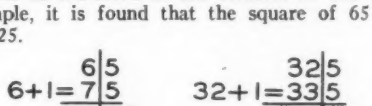


Fig. 6 Fig. 7

Example 3: Find the square of 325.
Solution:

Again, the work can be shortened by writing the problem as shown in Figure 7. Multiplying 32 × 33 = 1056, and placing it as shown, makes the total answer to the problem 105,625.

To Multiply Any Two Numbers Ending in 5

Example No. 1: Multiply 35 by 95.
Solution:

Step 1. Write the problem as shown in Figure 8.

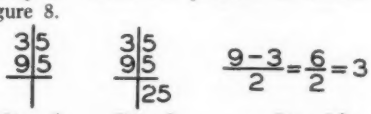


Fig. 8 Fig. 9 Fig. 10

Step 2. Multiply 5 × 5 and place the result beneath the horizontal line as shown in Figure 9.

Step 3. Subtract the smaller number (3) from the larger number (9) and divide the remainder by 2, as shown in Figure 10.

Step 4. Add 1 to the larger number (9) and arrange it on the paper as shown in Figure 11.

Step 5. Multiply the two numbers found on the left of the vertical line and place the answer beneath the horizontal line as shown in Figure 12.

Fig. 11 Fig. 12 Fig. 13

Step 6. To the answer on the left of the vertical line must now be added the result obtained in Step 3, as shown in Figure 13, thus obtaining 3835 which is the answer to the problem.

Example No. 2: Multiply 35 by 85.
Solution:

Step 1. Write out the problem as shown in Figure 14.

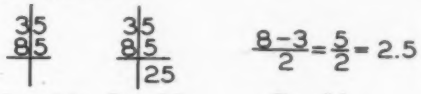


Fig. 14 Fig. 15 Fig. 16

Step 2. Multiply 5 × 5 and place the result beneath the horizontal line as shown in Figure 15.

Step 3. Subtract the smaller number (3) from the larger number (8) and divide the remainder by 2, as shown in Figure 16.

Step 4. Add 1 to the larger number (8) and arrange it on the paper as shown in Figure 17.

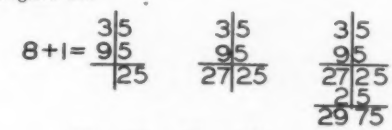


Fig. 17 Fig. 18 Fig. 19

Step 5. Multiply the two numbers found on the left of the vertical line and place the answer beneath the horizontal line as shown in Figure 18.

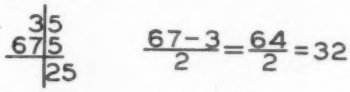


Fig. 20 Fig. 21

Step 6. To the answer on the left of the vertical line must now be added the result obtained in Step 3, as shown in Figure 19. Note carefully what is done with the 2.5 in this case.

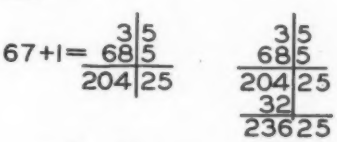


Fig. 22 Fig. 23

The answer, 2975, as shown by Figure 19, is the product of 35 × 85.

Example No. 3: Multiply 35 by 675.
Solution:

Follow steps 1 and 2 as already explained. See Figure 20.

Follow step 3 as shown in Figure 21.

Follow Steps 4 and 5 as previously explained. See Figure 22.

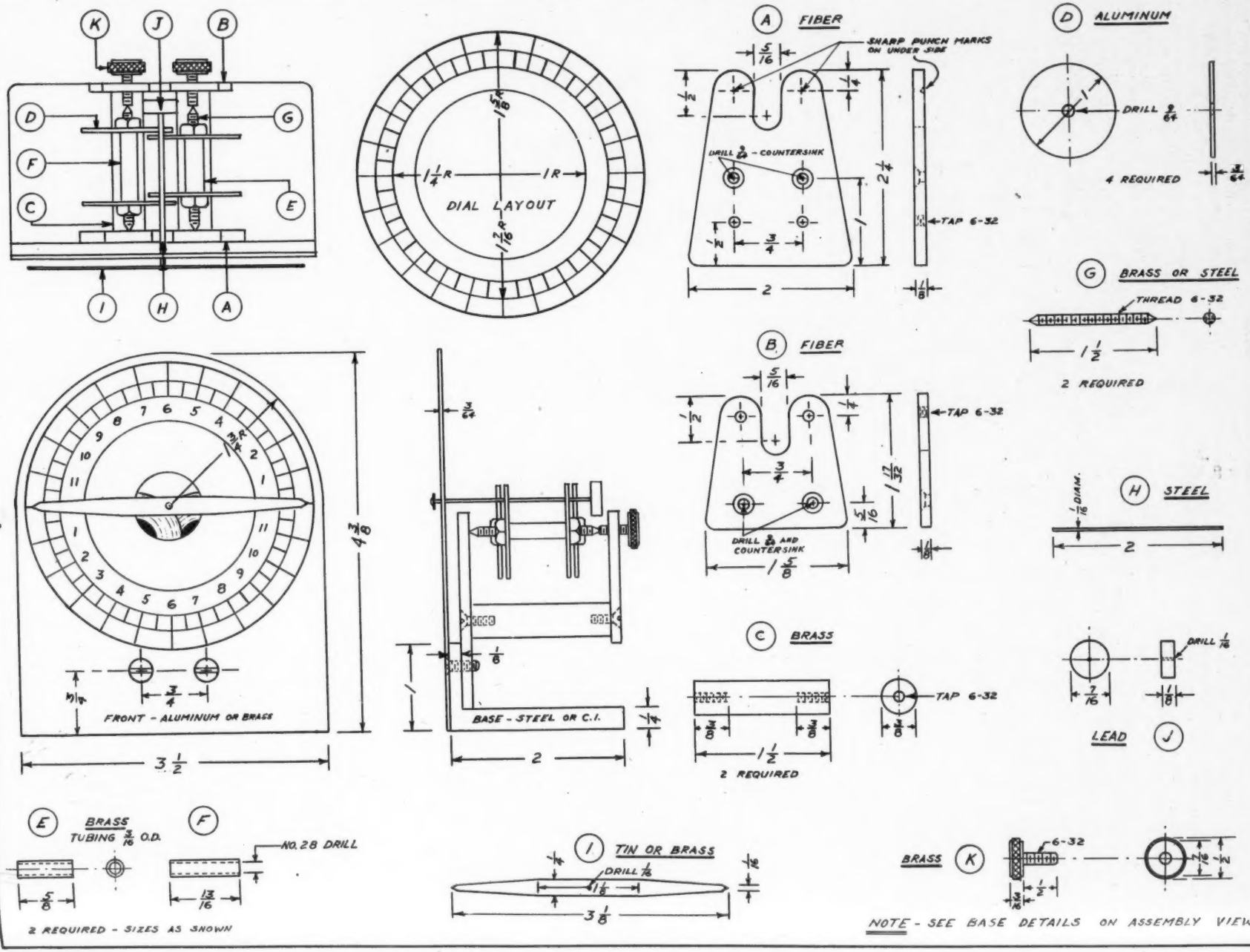
Then follow Step 6 as previously explained to get the answer. See Figure 23.

SENSITIVE EXPANSION METER

C. W. BLAKESLEE

Hastings High School
Hastings-on-Hudson, N. Y.

An instrument to accurately indicate visually the relative physical elongation of different metals when heat is applied is a very valuable instrument to have as equipment in any school machine shop. It is a recognized fact that metal changes its phys-



Assembly and details of sensitive expansion meter

ical length when the temperature of the metal is increased. This phenomena can be very effectively demonstrated by the use of the expansion meter, which if carefully made, assembled and adjusted, will respond quickly to indicate the expansion of the metal undergoing the test.

To demonstrate elongation of metal when heated, the instructor places a small rod or flat strip of metal about 36 in. long on the shaft marked *H*. One end of the rod or strip should project about 3 in. beyond the shaft, and the opposite end should be supported at the same height, but blocked so that it cannot move outward. The meter pointer is then set at either a horizontal or vertical reading by rotating by hand in such a direction that the end blocked or held rigid remains so. Heat is then applied to the metal rod or strip at about its center. It will be observed that the indicator will start to move at once indicating that expansion is taking place within the metal. Heat is applied for a definite length of time 20–30 seconds and the reading taken before the flame is removed. If sufficient time permits, the piece under the test may be left to cool down to room temperature and it will be noted that the indicator will return to its original setting. At this stage of the demonstration it may be desirable for the instructor to explain the scientific principles which caused the metal to elongate.

The sensitivity of this meter depends upon how carefully the details of its construction have been followed and in addition to what degree of precision the parts have been machined. The two roller units must be adjusted so that they revolve and spin freely. Shaft *H* must be absolutely straight so that it will contact the periphery of all four disks.

It will be found that this meter will serve as equipment to form a core for numerous demonstrations and experiments associated with the subject of machine-shop practice and its related work.

STRIPPING BASKET-WEAVE ARMORED CABLE

A. J. DOMINI

Instructor, Marine Electric Installation Classes
Brooklyn High School for Specialty Trades
Brooklyn, N. Y.

The A.I.E.E. bulletin No. 45 "Recommended Practice for Electrical Installations on Shipboard" (1940 Revision), Section 18.21h, specifies that, "The armor of wires and cables should consist of wires laid closely together, flat and parallel and forming a basket weave that should firmly grip the cable. The wire should be either galvanized steel, copper, bronze, or aluminum."

Many methods of stripping this armor are used by various mechanics engaged in the installation of electrical cables on shipboard. These methods involve the use of cable strippers, hack saws, and cable-skinning knives. All these methods take considerable time and some are dangerous inasmuch as the workman may cut himself or prick his hands with the ends of the armor wires, or cut into the wires or lead sheath of the cable while *ringing* the armor with the knife.

The author has perfected a safer and more efficient method using the D. H. Reddy Cutter, manufactured by the J. Wiss and Sons Company, of Newark, N. J.

Instructions for using the cutter follows:

1. Separate the basket-weave armor from the cable, at the end of the cable to be stripped. Use either a knife blade or the side of the cutter used for scraping the wires clean.

2. Insert the blade of the cutter into the open end of the cable between the armor and the wires as shown in the sketch. Exert pressure, in the direction of the cutting, before cutting. This tends to force the basket-weave armor together providing room for the cutter blade as the cutting progresses.

3. When the required amount of armor has been cut open use the cutter to trim off the armor around the cable. This makes a neat cut around the cable leaving no jagged ends, nor is there danger of cutting into the wires or the lead sheath as when the knife is used to ring the armor.

When lead-sheathed basket-weave armored cable is to be stripped some difficulty may be encountered in cutting the armor unless additional care is taken to exert pressure before cutting the armor as explained in operation No. 2. If the armor of the lead-sheathed cable is wound so tight that it is difficult to insert the cutter, the use of a cable stripper is advised and the trimming of the armor will be done with the cutter.

Other useful features of the cutter are:

1. A notch is provided for stripping insulation from the wires without injuring them.

2. Wires can be scraped clean by the specially designed sides of the cutterhead.

A RATIONAL ORDER OF INKING

AUGUST FLAM

Head, Industrial Arts Department
John Marshall High School
Los Angeles, Calif.

To assume that every pupil in a drafting class has been endowed by the Creator with a knowledge of inking and tracing, is bound to result in disappointment. The least we can do is to point out some of the pitfalls which beset the beginner.

For one thing, the most vital element in inking and tracing — that is the keeping of inking equipment clean — should be emphasized. A ruling pen which is clogged with dried ink, will not perform satisfactorily, if at all.

A logical and systematic order of inking should be one in which a piece of equipment is used on the entire sheet being traced or inked, and then put away for keeps, as far as that job is concerned. For example, if we start with the large compass, we should do everything that can or needs to be done with the large compass on that sheet, then clean that instrument and put it out of the way.

The following order of inking has been developed with that in view, and over a period of years, has proved effective.

Assuming that there are only two different line thicknesses* — heavy and light, the procedure is as follows:

1. Ink large heavy circles (Radii 1 in. and up).

2. Ink large heavy arcs (Radii 1 in. and up).

3. Ink large light circles (Radii 1 in. and up).

4. Ink large light arcs (Radii 1 in. and up). At this point the large compass is put away.

5. Ink small heavy circles (Up to 1-in. radii).

6. Ink small heavy arcs (Up to 1-in. radii).

7. Ink small light circles (Up to 1-in. radii).

8. Ink small light arcs (Up to 1-in. radii). The bow pen is then put away.

9. Ink irregular curves — heavy, then light.

10. Ink heavy horizontal lines.

11. Ink heavy vertical lines.

12. Ink heavy slanting lines.

13. Ink light horizontal lines.

14. Ink light vertical lines.

15. Ink light slanting lines.

16. Ink arrowheads, dimensions, notes, and all printing, including title.

This completes the entire work.

*"The Weight of Lines Used in Mechanical Drawing," page 226, June, 1929, issue, of the INDUSTRIAL ARTS MAGAZINE.

CORRECTION

In S. Theodore Woal's article, "Training Machinist Apprentices for National Defense," which appeared on page 232, in the June, 1942, INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, the 23rd line from the top in the second column which reads "are in no sense practical problems," should read "are in no sense practice problems."

KEEP YOUR PAINT BRUSHES CLEAN

C. W. MULLIGAN

Department of Agricultural Engineering
Cornell University
Ithaca, N. Y.

Good paint brushes can be used for a long period of time if they are properly cared for. Now, as never before, brushes should be salvaged and carefully preserved because new ones are difficult to obtain at any price.

If some of the brushes that you have discarded are good, with the exception that they contain dried paint in the bristles, it will be profitable to spend some time cleaning them. Even if the bristles are worn off so that they are of little value for painting, it may be worth while to clean the brushes for other uses.

There are several methods of salvaging old paint brushes. The paint may be cleaned out of some brushes by first soaking them for several hours in hot vinegar. When this weak acid has softened the paint the latter should be scraped and combed from the bristles with a putty knife and an old comb. Then wash the brush thoroughly with warm water and soap to remove all of the paint, and rinse with warm water, and then shake the excess water out of the bristles. The bristles should then be straightened and the brush wrapped in paper and tied up and hung away to dry thoroughly.

If this method does not remove the paint try following the alkali method which will soften most acid-resisting paints. Soak the brush for 24 hours in a warm solution containing a pound of sal soda in 3 pints of water. Then wash with warm water and soap. Rinse the brush in clean water, wrap in paper, and hang away to dry.

Another good method for removing dried paint from a brush is to soak it for several hours in a good commercial paint-and-varnish

remover. The softened paint or varnish should then be thoroughly scraped or combed out of the bristles with a putty knife and an old comb. Then the brush should be washed in warm water and soap, and rinsed in clean water.

For those who want to mix their own paintbrush cleaner, take 2 pints of kerosene and 1 pint of oleic acid. Mix these together. Then make a second mixture of ¼ pint denatured alcohol with ¼ pint 28 per cent liquid ammonia. Stir the second mixture slowly into the first until a smooth mixture results. To clean brushes, stand them into this brush cleaner overnight. Then, in the morning, wash them out with warm water.

The easiest way, of course, is to remove paint or other finishes from the brush while they are still fresh and easy to clean out.

Fresh paint is easily removed from the brushes by washing in kerosene, mineral spirits, turpentine, gasoline, or other solvents, and then washing with warm water and soap and rinsing thoroughly in clean water. To keep the bristles straight, they should be wrapped with paper and tied with cord and the brush hung up by its handle or laid flat to dry.

Another recommended method for cleaning fresh paint out of brushes is as follows: (1) rinse with turpentine or other paint solvents; (2) squeeze out; (3) soak in gasoline; (4) squeeze out; (5) soak in fresh gasoline; (6) squeeze out; (7) wash with strong soap, sal soda or trisodium and water; (8) squeeze out; (9) rinse in soft water; (10) dry.

Brushes used with plaster, whitewash, calcimine, or cold-water paint should simply be washed in water. A little vinegar added to the water will assist in removing these materials. If a brush has been used in shellac, it should be washed in alcohol and then washed with hot water and soap and thoroughly dried. Lacquer brushes must be cleaned with lacquer thinner.

POCKET-WINGED AIRPLANE KITE

TERENCE VINCENT

U. S. Director
Miniature Aircrafters
Ypsilanti, Mich.

Pockets on the flying surfaces of the airplane kite, described herewith, increase the performance noticeably. These pockets tend to get the kite aloft in a much lighter breeze than is otherwise possible.

Bill of Materials

No. required	*Material*	*Size*
2 pcs.	Medium balsa or spruce	3/8 x 3/8 x 51 in. ¼ x ¼ x 51 in.
1 pc.	Hard balsa or spruce	1/16 x 3/8 x 45 in. ¼ x ¼ x 45 in.
2 pcs.	Hard balsa or spruce	1/16 x 1/16 x 20 in. ⅛ x ⅛ x 20 in.
1 pc.	Hard balsa	⅛ x ½ x 7 in.
*1 pc.	Hard balsa or spruce	1/16 x 1/16 x 70 in. 1/16 x 1/16 x 70 in.
**1 pc.	Bamboo	1/16 x 1/16 x 75 in.
2 pcs.	Balsa	3/16 x 1 x 1 in.
2 pcs.	Balsa	½ x ¾ x 8 in.
1 pc.	Reed	⅛ x 120 in. (Body, tips)
2 pcs.	Steel wire	.033 x 2½ in.
12 pcs.	Beads or washers	
4 pcs.	Rubber bands	No. 32
	Cement or glue	
	Library paste or banana oil n.c.p.	
3 sheets	Paper or very thin silk	20 x 24 in.
	Linen or silk thread, or string	about 12 ft.

*Braces of needed lengths are later cut.
**Reinforcements are cemented and tied over braces and edges of balsa when needed.

Method of Procedure

Slightly sand off the edges of the two 3/8 by 3/8 by 51-in. wing edges or spars. This is to avoid cutting the wing pockets, as they flap in the winds. Follow the same process with the two 3/16 by 3/16 by 20-in. elevator edges.

Elevator: Lay the edges parallel on a flat surface, and insert the end braces or ribs so the outside measurement is 5 in. Cement the ends in place. Insert the two center braces, leaving about ½-in. space in the middle.

Wing: Place the two 10-in. mid braces 10 in. apart between the two wing edges. Cement the connections firmly. Next insert the two 7½-in. braces and the end braces, and cement them in place. Because of the stresses and strains in flight, it is recommended to tie a loop of string or strong thread over and around each one of these connections, giving each a touch of glue or cement after the knots are tied.

The next step is to cement a semicircle of reed to the ends with an inch or two overlap on the outsides. These joints should also be reinforced with thread, as shown in the detail sketch.

Dihedral: After the wing connections all are thoroughly firm and dry, the dihedral is put in by soaking the middle 12 in. of the wing frame in water for some time. Then set the wing frame on top of blocks which are over 10 in. long and stand about 7 or 8 in. high. Next place sufficient weight across the top mid portion of the wing frame, to bend it so that the wing tips are about 7 to 8 in. above the mid sections of the wing edges.

Let the wing dry thoroughly in this position until the dihedral is permanent.

The elevator may be made perfectly flat, or it may be given a dihedral paralleling that in the wing.

Flying Pockets: The flying pockets are attached in either of the two ways shown in the illustration. The paper or silk may be attached with paste, glue, banana oil, or with cement. Only the underside of the edge, as shown, is covered with adhesive.

The paper or silk for the pockets are made ⅛ to ¼ in. narrower than the width of the pocket space between the braces, and from 2 to 4 in. wider than the space between the outsides of the parallel edges of the elevator, and the diverging edges of the wing.

While the wing and elevator are drying thoroughly, the rudder and the body should be made.

Body: The 10 by 10-in. middle section of the main wing is left open. This portion will be closed by the body when that is attached with strong string at points *A, B, C,* and *D.* Lay the body outline on a flat surface and place pins wherever a corner or curve occurs. If the reed is soaked in water for a short while it will bend more easily.

Cement the ends of the reed to the front end of the 5/16 by 3/8 by 45-in. body stick, leaving about ½ in. of the stick extending beyond the reed. Bend the reed around the pins so that a 10 by 10-in. frame is formed which is later fastened at the mid section of the wing as shown.

Then bring the two ends of the reed together and fasten them under the tailstick about 6 in. from the tail end. Cement and tie these ends in place, and cut off excess reed.

Apply paste to the top of the body stick, and attach the paper full length. Next apply paste to the underside of the reed, full length on both sides, and fold the paper (or silk) up and over, with sufficient overlap to insure holding during flight.

Bore a small hole about 4 in. from the front of the body stick for attaching the flying string or bridle. The other end of the bridle is fastened over the body and the trailing edge of the wing.

Rudder: Cement the bamboo parts of the rudder firmly to the ⅛ by ½ by 7-in. hard balsa bottom base, so the rudder's outline is 10 in. high over all, with a semicircular tip whose diameter is 5 in. Then glue the covering in place, and place the rudder flat on a table, with a brick or board on top until thoroughly dry. After drying, the rudder should be fastened with cement and thread to the body and elevator.

Propeller Mountings: Two or four propeller mountings, with propellers, may be put in place on the wing as shown. The pieces of balsa 3/8 by 1 by 1 in. are carved in a semicircular shape as shown, and cemented to the edge of the wing. Steel wire is inserted through this block, into the wing edge and into the brace.

Place two or three beads on each wire, then the propeller, and several more beads or washers, after which a curve or loop is formed on the free wire ends. The propellers should be parallel to the wing edge, and each propeller may be as long as the width of a wing pocket. After the propellers are in place, the beads and washers may be oiled a little, so that the propeller will revolve easily.

Assembly: Two methods of assembly are at once evident. (1) Place the body under the wing, and tie the two together at points *A, B, C,* and *D;* or (2) put the nose of the body through the 10 by 10-in. square in the wing's mid section, with the leading edge of the wing on top, and the trailing edge underneath, and tie them together firmly at points *A, B, C,* and *D.*

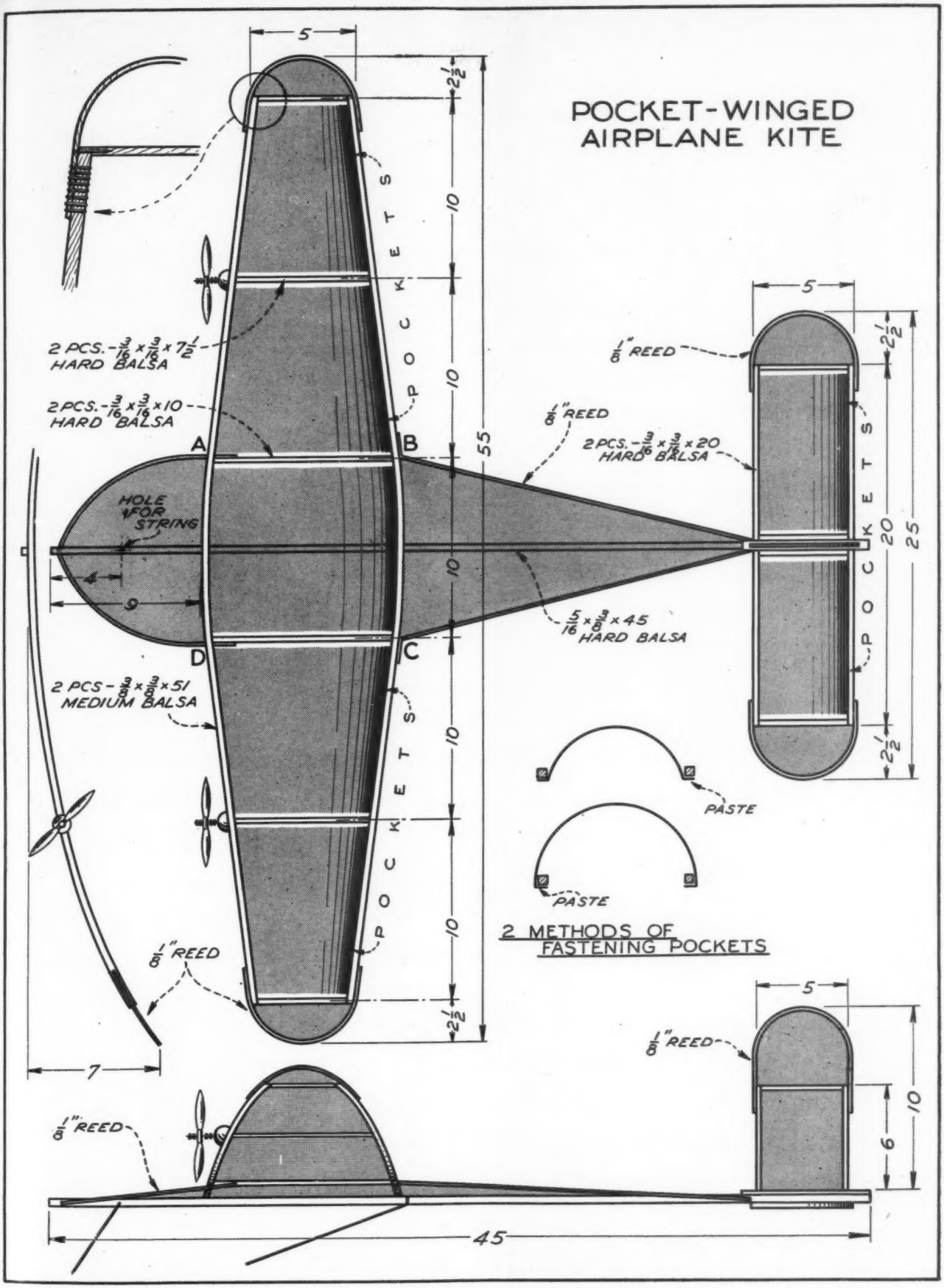
Then put the elevator either over or under the tail end of the body stick, and fasten it in place firmly.

Tie the bridle as shown, or with the second end attached further back somewhere between the trailing edge and the rudder, as trial flights may indicate as being right for best flights.

Flying: For preliminary tests, fasten the flying string loosely to the bridle as shown. Let the breeze blow the kite up a short ways. If all seems well, then tighten the string to the bridle.

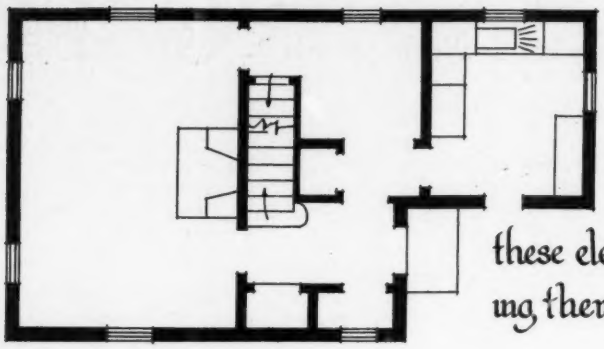
If the wind is brisk, just let it blow the airplane kite away, as the string is slowly paid out. If the ground wind is not sufficiently strong to lift the kite, let an assistant hold the kite above his head, with one hand in front of the rudder around the body stick, and the other hand supporting the underside of the wing. When the runner is ready, some 50 or 100 ft. away, he should begin running when the kite leaves the holder's hand. Remember, the kite must not be tossed into the air by the assistant.

This airplane kite rarely weighs over 4 oz., and with all balsa construction, may be but 2 oz. in weight.



Pocket-winged airplane kite designed by Terence Vincent

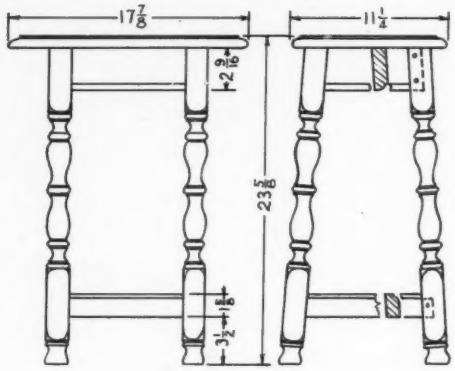
WHAT DOES 'DESIGN' MEAN?



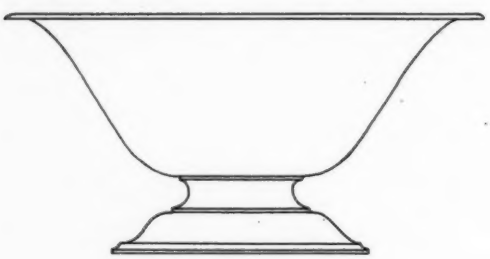
Floor Plan

When a house is planned, the architect studies the needs of the owner, and decides what building features are necessary to supply these needs. He organizes these elements into a unified plan, adjusting them to secure the best use of each.

The furniture designer knows styles, woods, and methods of working and joining parts. His plans show the cabinetmaker all of the essential requirements of form and construction.



Jacobean Stool



Fruit Bowl

A silversmith uses a plan in order to work without waste of time and material. It is much easier for him to make changes on paper than to alter a costly piece of metal, once it is partly shaped.

Symbols are short-cut devices designed to convey ideas. They may represent one's country (a flag); an organization (a badge); or a family (coat of arms). Decorative forms are frequently archaic symbols.

Bookplate (Czechoslavakia)

A DESIGN IS A PLAN.

Plate 1. Design course by Burl N. Osburn, Director of Industrial Arts, State Teachers College, Millersville, Pa.

WHAT ARE THE QUALITIES OF GOOD DESIGN?

Baltimore Clipper

1. It is fitted to the purpose for which it was planned. Otherwise, it may be said, the design might better not have been made. Satisfaction in the results of planning is directly proportional to the degree to which this quality is present. The huge dam, braced against impounded water; the sleek, stream-lined combat plane; a Stradivari violin; a Lancaster County barn; and an ax handle, all declare the ability of man to meet problems by trial or by scientific techniques. When well designed, "form follows function."

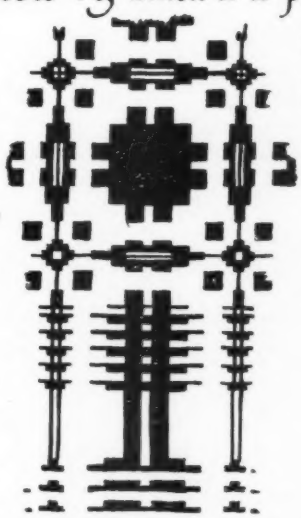
2. It is suitable to the material of which it is made.

A good design discreetly emphasizes the peculiar qualities of a material. It equally recognizes a limiting range for each material. Imitations have no place if this quality is to be attained. New materials are welcomed by the designer when they help him solve new problems, or meet old problems with improved results.

Anvil

3. It is fitted to the processes by which it is produced.

Character and distinction are given to an article when it is designed to show frankly, but without exaggeration, the methods by which it is produced. Fakes in production, intended to give a false idea of value, are evidences of dishonesty unworthy of the able craftsman. The skilled designer uses his knowledge of tools and machines to permit correct and, therefore, economical manufacture.

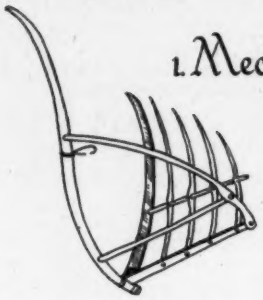


Snowball Coverlet

These three qualities demand that the designer be a person of high integrity, with knowledge of the functions of living and of human needs. He must be acquainted with materials, and with techniques of production.

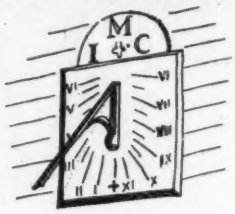
Plate 2. Design course by Burl N. Osburn, Director of Industrial Arts, State Teachers College, Millersville, Pa.

WHAT IS MEANT BY THE TERM 'FUNCTION'?



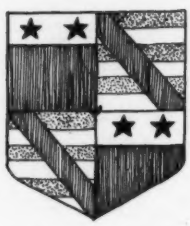
Grain Cradle

1. Mechanical Function



Wall Sundial

A device is said to function if it 'works.' To design a functional article of any kind, the designer must be an 'engineer.' He must estimate strengths of materials, direction and amount of force, qualities of materials, structure, and operational needs.



Arms of N. Bacon

Girl Scout Emblem

Imprint of Aldus Manutius

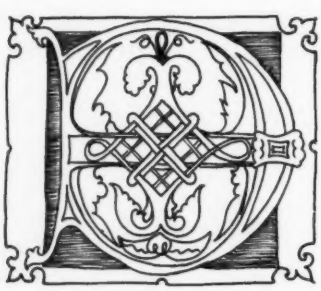
Signal Corps Badge

2. Publicity Function

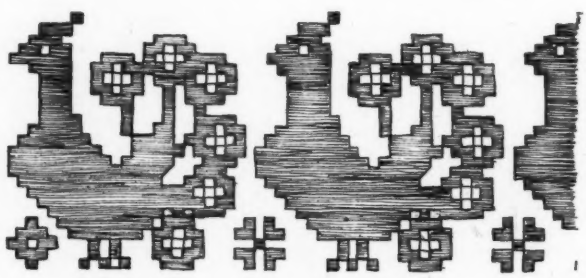
Every design is significant for the message it conveys. A symbol, as those shown above, indicates membership, ownership, position, or interest. Just as 'clothes proclaim the man,' so may a building and its furnishings symbolize the stability of government, the social unconcern of the slums, or the pride of a home owner.

3. Other Functions

The chief purpose of a design may also be to give pleasure through its form, line, color, or texture. A craftsman often demonstrates that one of the major purposes is to afford him the pleasure of using his skill, and of expressing his feelings through his work. Any or all of these functions may characterize a design.



12th Century Manuscript Initial 'D'



Motif from Swedish Dukagang Weaving

Plate 3. Design course by Burl N. Osburn, Director of Industrial Arts, State Teachers College, Millersville, Pa.

(This series is to be continued)

GRINDING WHEEL SAFETY

J. E. DONALD HASTIE

The Carborundum Co.,
Niagara Falls, N. Y.

Many cases of wheel breakage can be traced directly or indirectly to careless handling of improper methods of unpacking and storage. Wheels damaged in this way may, to all outward appearances, seem perfect but at the same time, constitute a very real hazard.

Safety in the Receiving Room

Unpacking. All wheels are inspected by the manufacturer prior to packing and are delivered to the transportation company in perfect condition. They should be unpacked and inspected as soon as received to determine if the wheels have been damaged in transit.

Note first the condition of the container. If it appears to have been subjected to rough handling and contents damaged, have it held intact and request the transportation company to inspect the shipment.

If the container is in good condition, open, exercising care that the tool used does not damage the contents. There is a right and wrong way of opening each of the several types of containers used in shipping abrasive wheels and a few suggestions on the subject are offered.

Opening Barrels: The top hoops should first be removed before the head is knocked in.

Wooden Boxes: Remove all nails from the lid with a nail puller. Do not attempt to knock the lid off with a hammer.

Fiber Cases: A screw driver should be used to remove the metal staples after which the four sections of the top may be folded back. The packing material may then be loosened and the wheels lifted out and placed on a bench.

Inspection. Clean all packing material from the wheels with a brush. Check quantity, size, grit, grade, and bond against packing slip and invoice.

Fig. 1. Testing for soundness

To check for imperfect wheels, where size permits, the wheel may be suspended by slipping one finger through the hole and tapping gently with a light instrument, such as the handle of a screw driver. See Figure 1. For very large wheels use a wooden mallet. If a clear ring is not produced, examine the wheel for cracks. If evidence of a crack is found, that wheel should be set aside and notice sent to the manufacturer.

To obtain comparable sound effects, the wheels should be struck at approximately the same spot in relation to the support.

All wheels do not produce the same tone when rung; nor does a low tone signify a cracked wheel:

1. Vitrified and silicate wheels emit a clear metallic ring.
2. Organic bonded wheels give a less clear sound but the sound of a cracked wheel will be perfectly apparent.
3. Oil- or water-soaked wheels do not ring clearly.

Wheels are often filled by the manufacturer with various resins and greases to modify cutting action. This deadens the tone of the wheel.

Safety in the Storage room

Wheel Storage. All stocks of abrasive wheels should be stored in racks in a central storeroom under the supervision of an individual who has been carefully instructed in the care and handling of wheels. In the larger shops where quantities of abrasive wheels are consumed, it is advantageous to select a person for this important position who possesses a broad knowledge of the use of grinding wheels.

In general, all straight wheels 6 in. in diameter and larger should be placed on edge in suitable racks in such a way that they cannot tip over or roll. See Figure 2.

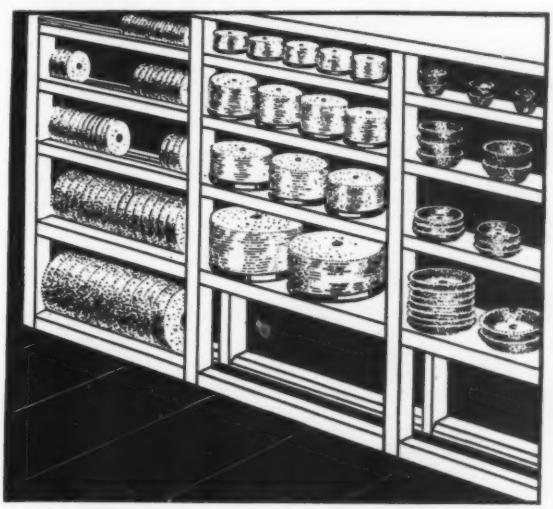


Fig. 2. Storing grinding wheels

Straight wheels less than 6 in. in diameter, flaring cups, and dish wheels, are best stacked flat with a cushioning material such as corrugated paperboard between them.

Straight cup wheels may be stored either flat or on edge.

Very large wheels can be stored in their original containers.

Small wheels are best stored in bins or drawers, as their size makes it next to impossible to carry them stacked in racks.

All thin resinoid, rubber, and shellac bonded wheels, regardless of diameter, should be stored flat, one on top of the other, on a perfectly flat surface or batt, to prevent warpage.

Wheels with tapered sides should be stored flat with spacers of corrugated board between them or stored on edge. When stored flat, they should not be stacked more than a few high.

Safety at the Machine

Stocking at the Machine. Where it is necessary to change wheels on a machine frequently to accommodate different classes of work, a rack may be provided at the machine for holding the extra wheels, rather than keeping them in the storeroom. In this case, when one wheel is removed from the machine and another substituted, the extra wheel should be placed in the rack at once or returned to the stock room for safekeeping.

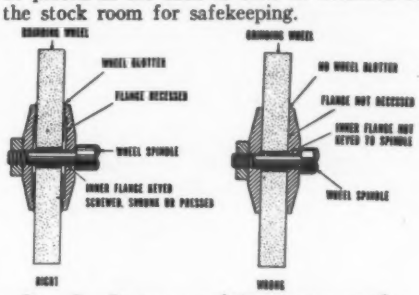


Fig. 3. Proper and improper methods of mounting wheels having small holes

The practice of stacking wheels, which are to be again placed in service, on the floor or on benches in the shop is to be condemned. This is because of the danger of the wheels becoming oil soaked, falling off the benches, or being struck.

Mounting Wheels. Before mounting, every wheel should again be closely inspected and rung after it has come from the stockroom to make sure that it has not been fractured while in stock or through subsequent handling. Any evidence of a loose or shifted bushing should be carefully looked for, particularly on a wheel that has been rebushed or remounted by the user. Also see that the bushing does not extend beyond the side of the wheel. See Figure 3.

See that the wheel slips freely on the spindle without binding. In general, the hole size should be about 0.005 in. larger than the spindle diameter for hole sizes larger than 5 in. In case the wheel shows a tendency to bind, the bushing should be very carefully scraped or reamed to give an easy, sliding fit.

As illustrated, there must be a flange on each side of the wheel and these flanges must be of *equal diameter.* All flanges must be relieved in the center so that the bearing surface will be on the outer unrelieved portion of the flange.

The inner flange should be keyed or otherwise fastened to the wheel spindle. When mounting the wheel on the spindle it should be pushed snugly against the inner flange with a blotter (often called a washer) between them.

Wheel blotters or washers no smaller than the flange diameter *must* be fitted between the wheel and the flanges. Blotting paper washers must not be thicker than 0.025 in.

Check to make sure that the wheel bears uniformly around the bearing surface of the flange.

Place another wheel blotter on the outside of the wheel and fit the outer flange against it and the wheel. Check again to make sure that the flange bears against the wheel uniformly. The outer flange should have an easy, sliding fit on the spindle so that it can adjust itself slightly to give a uniform bearing on the wheel and blotter.

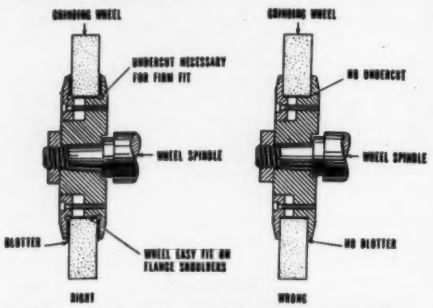


Fig. 4. Proper and improper methods of mounting wheels having large holes

In the case of a wheel collet or mount as used on precision grinding machines, the collet or mount is removed from the wheel spindle and the same procedure is followed. Small screws or bolts are used in tightening the two flange members which hold the wheel on the collet.

Fig. 5. Follow this suggested procedure of tightening bolts on a wheel collet

Care must be exercised in tightening the several bolts to give uniform pressure. First run up all the bolts with the fingers. Then tighten one bolt and do the same with the bolt diametrically across. Continue as shown in the diagram below until all of the bolts have been tightened. The procedure is identical to that followed when mounting a wheel on an automobile. See Figure 5.

Tighten the spindle end nut against the flange enough to hold the wheel firmly. However, it should not be tightened with too great a pressure as excessive strains may be set up in the wheel.

Correctly mounted, the wheel should be held tightly enough between the flanges to prevent wheel slippage and to transfer the driving torque, but not enough to approach the ultimate crushing strength of the wheel. Power should be transmitted from the spindle through the flanges to the wheel.

The foregoing procedure is also followed when mounting wheels with large holes. With this type of wheel the arbor hole fits on a boss, which is an integral part of the wheel mount or flange. See Figure 4.

When first starting up a new wheel or one that has been remounted, it is advisable to stand to one side and allow the wheel to run at full operating speed for at least a minute. Then the wheel should be trued with an approved dressing tool. This will eliminate any eccentricity due to mounting. The truing is worse than useless unless it is done against a fixed rest or with the dresser fixed in position so that the tool does not simply follow the original contour of the wheel.

Proper Wheel Speed. It is presumed that the operating speed of the machine, on which the wheel is to be mounted, is known. If this is not the case, the speed should be checked to make sure that it does not exceed the maximum operating speed shown on the Preserve Tag accompanying the wheel.

The basic authority on the subject of safety pertaining to the operation of grinding wheels is a booklet "American Engineering Standards Safety Code for the Use, Care and Protection of Abrasive Wheels — B7-1935" approved by the American Standards Association. All persons handling, supervising, or operating grinding machines or wheels should be thoroughly familiar with its contents.

Types of Wheels	Vitrified and Silicate Bonds			Organic Bonds		
	Soft	Med.	Hard	Soft	Med.	Hard
	F.P.M.	F.P.M.	F.P.M.	F.P.M.	F.P.M.	F.P.M.
*Type 1--Straight Wheels *Type 4--Taper Wheels	5,500	6,000+	6,500	6,500	8,000	9,500
*Types 5 and 7--Recessed Wheels	5,500	6,000+	6,500	6,500	8,000	9,500
*Type 2--Cylinder Wheels	4,500	5,500	6,000	6,000	8,000	9,500
**Dovetail Wheels *Types 11 and 12--Dish and Flaring Cup Wheels Type 13--Saucer Wheels	4,500	5,500	6,000	6,000	8,000	9,500
*Type 6--Deep Recessed Cup Wheels	4,500	5,000	5,500	6,000	7,500	9,000
Cutting Wheels Larger than 16" diam.						7,500 to 14,000
Cutting Wheels 16" and smaller diam.						10,000 to ++ 16,000

Maximum speeds indicated are based on the strength of the wheels and not on their cutting efficiency. Best speeds may sometimes be considerably lower.

*Standard Shapes (Dept. of Commerce---Simplified Practise Recommendation R45-28).
**Non-Standard Shapes.
+On precision machines, vitrified and silicate wheels in medium grades may be operated at 6,500 peripheral feet per minute.
++Depending on Stability and Design of Machine.

Table I. Speeds for grinding wheels

For your further information, a portion of Section X of the Safety Code reads as follows:

Section X — Speed

"*Operating Speed.* The following table indicates maximum peripheral speeds for various types and grades of wheels. These speeds shall not be exceeded except upon the distinct recommendation of the grinding wheel manufacturer for each specific case, and then only if the user maintains his equipment in a condition satisfactory to the wheel manufacturer.

"When wheels of unusual and extreme shapes such as deep cups with thin walls or backs, long drums and so forth are required, consult the wheel manufacturer for speeds recommended." See Table I.

"*Speed Test.* Machine spindle speeds shall be tested and determined correct for size of wheel to be operated, before the wheel is mounted, and shall never be changed as wheel is reduced in diameter, except by men assigned for such duties."

"*Speed Adjustment Control.* Where speed of wheel spindle is adjustable, speed adjustment shall be in control of authorized persons only."

Recommended Wheel Speeds

The generally accepted speeds for safe and efficient operation for various types of grinding operations are shown in the following table:

Grinding Operation	Speed in Surface Feet per Minute
Cylindrical grinding	5,500 -- 6,500
Internal grinding	2,000 -- 6,000
Snagging, offhand grinding (vitrified wheels)	5,000 -- 6,000
Snagging (rubber and resinoid wheels)	7,000 -- 9,500
Surface grinding	4,000 -- 5,000
Wet tool grinding	5,000 -- 6,000
Rubber, shellac and resinoid cutting off wheel	9,000 -- 16,000

Table II. Grinding wheel speeds for various operations

Personal Safety

When operating any grinder, the following personal safety precautions should be observed:

1. Wear safety goggles at all times when performing any grinding operation.
2. See that all safety equipment (guards and hoods) is in place.
3. In offhand grinding keep work rest adjusted close to the wheel. A maximum distance of ⅛ in. is recommended to prevent the work from being caught between the wheel and the rest. Securely clamp the work rest after each adjustment.
4. Avoid personal contact with moving wheel or work.
5. See that clothing does not come into contact with the moving wheel or work. A loose necktie or shirt may catch between the fast-moving wheel and the work and draw you into the machine.

To the building of a stronger America the schools of the Nation are dedicated. By the patient processes of instruction and training they seek to develop in the youth of the land those essential knowledges and skills and that devotion to our democratic way of life which make for national strength and unity.

— John W. Studebaker,
U. S. Commissioner of Education

WHITTLING-JACKKNIFE TECHNIQUE

W. BEN. HUNT
Hales Corners, Wis.

(Continued from page 266 of the June, 1942, issue)

Totem poles are interesting to most people, because almost everyone is acquainted with these peculiar pieces of our art which our northwest Indians place in front of their houses. Each of these totem poles tells a story or is symbolic of the family who owns it. They are usually carved out of huge cedar logs with axes, chisels, and adzes.

The ornamental totem poles shown here are only 12 and 13½ in. high. This is a handy size for whittling. They may be made of any size, however, from ornamental pins 2 or 3 in. high to regular totem poles 10 or 20 ft. high. The ornamental totem poles may be made from a square of wood rounded off on one side, or from a softwood sapling flattened off on one side, as shown in Figure 87.

Each of the two poles shown in Figures 88 and 89 consists of several units. The one shown in Figure 88 is symbolic of the raven and the wolf. These ornamental poles can be painted if desired. White, black, red, brown, blue, green, and yellow are colors usually used, but much of the beauty of the whittling is lost when it is covered with paint. If the poles are simply tinted a brownish gray resembling old weathered totems, they will appear realistic and retain the knife cuts. A square or round base may be nailed to the bottom of the totems to stabilize them.

Lay out the largest units or parts with a pencil and start by roughing out each one. Then put in the details with the pencil.

The shading has been omitted in the drawings to avoid confusion. Study the halftones in Figure 90, to get the various planes.

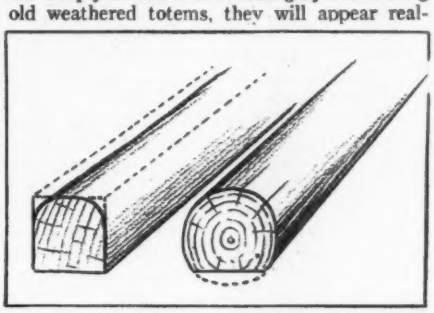


Fig. 87. Square or round pieces used for making totem poles

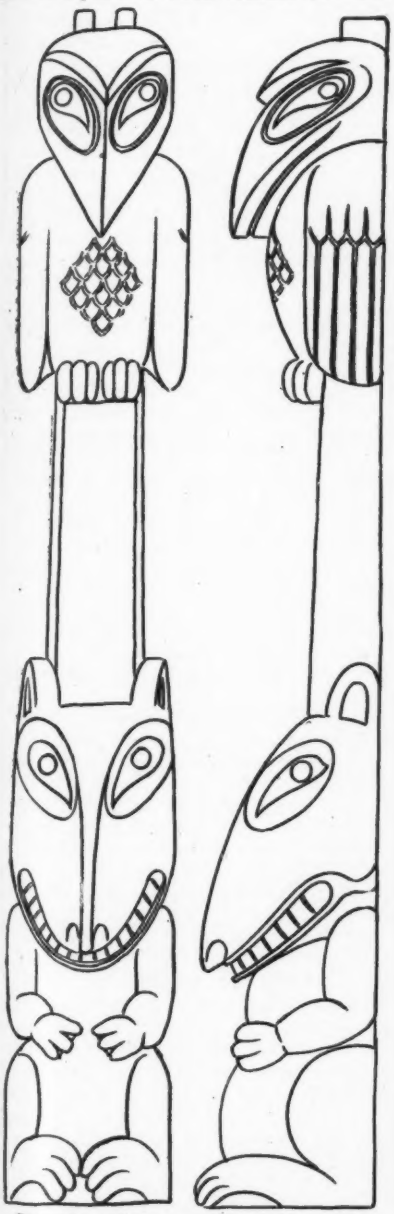


Fig. 88. The raven and the wolf totem pole

Fig. 90. Totem poles

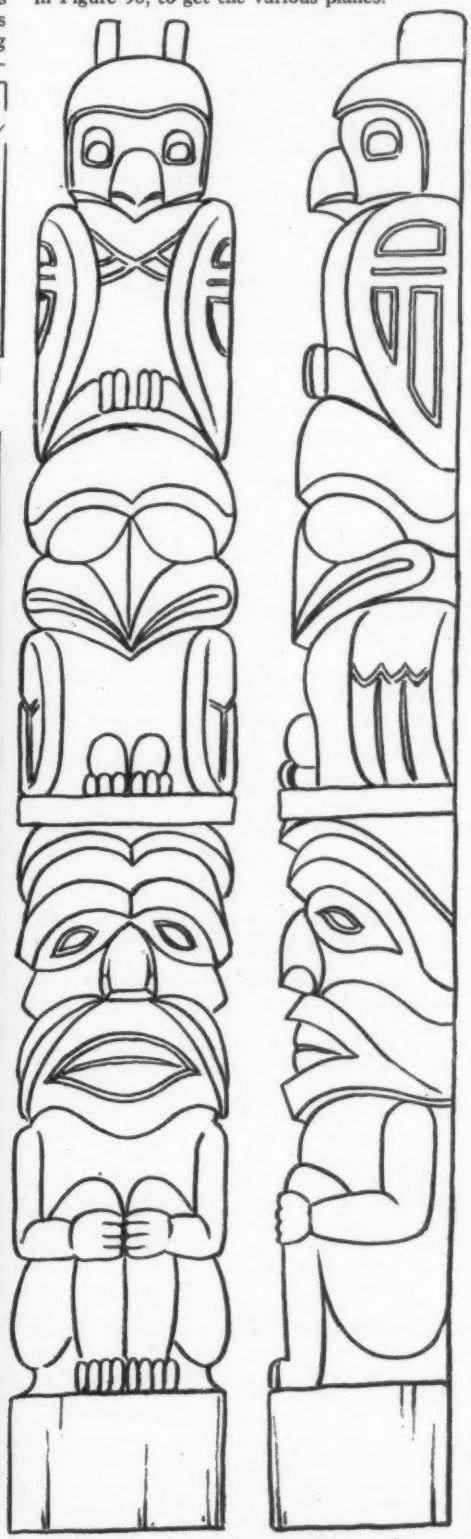


Fig. 89. A miniature totem pole

Charles A. Bennett

(Continued from page 292)

leave Dunedin until May 20, when their season railroad tickets were about to expire.

On Wednesday morning, June 17, Mr. Bennett drove to the office of The Manual Arts Press about 11 o'clock, where he attended to some correspondence, and conferred with Mr. Simpson concerning the manuscripts of two books on which he was working, and outlined his plans for completing them. Leaving the office at noon, he stopped in the bank on the way home. While there he suffered a fainting spell, but recovered soon, and insisted on driving home alone. Shortly after arriving at the apartment, he was taken with another attack. His physician was summoned, but little could be done, and the end came at 3:30 p.m. The physician pronounced the immediate cause of death as coronary thrombosis. At his bedside were Mrs. Bennett, their daughter Emily, his physician, and the nurse.

The funeral service was held at Cumerford Chapel on Saturday morning, June 20, conducted by Rev. B. G. Carpenter and Rev. A. F. Jensen. Interment was in Parkview Cemetery. The memorial address was given by Dr. Carpenter, who said, in part:

"A service in memory of Charles A. Bennett is full of rich, profound, and inspiring meanings. All over this land and in many foreign countries his name was known and highly respected.

"A pioneer in the field of education, he introduced art — the sense of the beautiful — into manual training, and originated the term, 'manual arts.' . . .

"It is a life vision-led and love-inspired. In home and church and civic life, the measure of his loving services was full, 'pressed down and running over.'

"In this life we find the rare combination of ideal and actual, of dream and deed, of faith and works. Righteousness is the foundation on which liberties rest. Liberty to live must be lived, and Charles A. Bennett lived it."

Only a few weeks ago I received a letter from Mr. Bennett in which he wrote about the two manuscripts on which he was working, saying:

"There are two professional things I want to accomplish if my health holds out long enough:

"First, I want to complete the manuscript for a book that will probably bear the title, *Pioneering in Industrial Education*. It will describe and discuss some of my experiences as teacher, school principal, graduate student, college professor, department head, author, editor, association officer, and European traveler. It will refer to many of the problems of manual training, industrial arts, vocational education, and teacher training as they came forward for solution.

"It is intended to supplement my two books on the *History of Manual and Industrial Education*, with more personal observations and experiences. It will contain some of the material that professional friends have told me I ought to put in print about the early leaders in our professional field because of my contacts with a large proportion of them in this country and some in Europe.

"Second, I want to add something more to the discussion of methods of teaching. I wrestled with this subject in my earliest teaching experiences, and it has continued to interest me up to the present time. In my book, *The Manual Arts*, methods of teaching shopwork were classified in a way that has been quoted by other writers. To the *Industrial Education Magazine* I contributed a few paragraphs on the subject now and then, but I never found time to study the subject as I wanted to.

"In the recent publication, *Selected Projects and Teaching Procedures*, I have taken up the subject again. With the assistance of a number of men in the profession, I hope to round out the treatment of the subject."

We know now that Mr. Bennett completed four chapters of the *Pioneering* book, and outlines for other chapters. He had also accumulated a considerable amount of material on methods of teaching through correspondence with a number of teachers and supervisors. Thus, as indicated at the beginning of this sketch, Mr. Bennett was occupied to the very end with undiminished intellectual enthusiasm upon plans for the future, even though declining physical vigor necessarily enforced a slower pace.

Mr. Bennett was graduated from Worcester Polytechnic Institute, Worcester, Mass., in 1886, and then worked as a machinist at Brown and Sharpe Mfg. Co., Providence, R. I.

In 1887–88, he taught manual training in the high school, St. Paul, Minn., and then for three years served as principal of the newly organized St. Paul Manual Training School. From 1891 to 1897, he was professor of manual arts, Teachers College, Columbia University, New York City, and from 1897 to 1919, head of the Department of Manual Arts, Bradley Polytechnic Institute, Peoria, Ill.

In 1891 he married Clara Emily Blodgett, of St. Paul. Mrs. Bennett has been a leader in developing study courses in several mothers' clubs in Peoria, and served on the State Board of the Illinois Congress of Parents and Teachers. For several years she was a member of the governing board of the Peoria Young Women's Christian Association, and served as its president. Also she was active for many years in child welfare. There are two children: a son, Howard G., head of the department of music, University of Vermont, Burlington; and a daughter, Emily, a former teacher of home economics, wife of Professor Russell M. Kerchner, department of electrical engineering, Kansas State College, Manhattan.

In 1899, Mr. Bennett founded the *Manual Training Magazine*, and in July, 1922, changed the name to *Industrial Education Magazine*. In 1903, he organized The Manual Arts Press, in Peoria, to publish the magazine and, as it afterward proved, a series of professional books and textbooks in industrial education and related fields.

He served as guest professor in summer sessions at the University of Wisconsin, Iowa State College, and California State College, Santa Barbara.

For many years he was active in many professional organizations of teachers: National Education Association, serving one year as president of the department of manual training; Vocational Education Association of the Middle West, president; Western Arts Association, president, chairman of the Council; Manual Arts Conference of the Mississippi Valley, founder and first director; American Vocational Association: Illinois Manual Arts Association; and others.

In addition to the extensive series of editorials and articles contributed to *Industrial Education Magazine* and other journals, he was the author of several notable and successful books, chief of which is the two-volume *History of Manual and Industrial Education*. Also, *The Manual Arts, Industrial Arts in Modern Education*, editor; *Art Training for Life and Industry; Beginning Problems in Mechanical Drawing; Problems in Mechanical Drawing*.

In 1939, Mr. Bennett relieved himself of a considerable burden by discontinuing the publication of *Industrial Education Magazine*. In 1940, he gave up the major responsibilities of president of the Manual Arts Press, turning these over to Mr. Laurens L. Simpson, who came to the Manual Arts Press as treasurer, in 1910. Mr. Bennett continued in an advisory capacity as chairman of the board of directors.

Other Activities

A complete account of Mr. Bennett's life requires some mention of the place he made for himself in the community, Peoria, Ill., where he spent nearly 45 years. For one who devoted so much time and energy to his chosen profession, Mr. Bennett was unusually active in civic and social affairs. He was a member of the Congregational Church, and was active in a number of capacities, including service as editor of *The First Hundred Years*, a history of the Peoria church. He served for 27 years as secretary of the Peoria Neighborhood House Association. He helped organize the Peoria Society of Allied Arts, and served as the first president. In 1927 he was director of the Peoria Art Institute.

He was a lifelong student of art, and spent many vacation hours painting and sketching. At exhibitions his work was praised for color and perspective. He designed and built a fine home on Columbia Terrace, in the Peoria Uplands district. In landscaping the grounds he made a thorough study of the subject and acquired some distinction as a gardner. He was also for many years an active member of the University Club, and of the Peoria Optimist Club. He helped organize and was long an active member of the Peoria Scribblers Club, in which serious study was made of the techniques of writing.

One of his old friends in Peoria wrote this tribute:

"To all his varied activities, Mr. Bennett contributed an unusual zest and energy, combined with an old-school, gentlemanly, New England charm that was as much a part of his character as the work he accomplished."

In addition to the widow and two children, Mr. Bennett is survived by a sister, Mrs. Harris W. Moore, of Watertown, Mass., and a brother, Fred E. Bennett, of Leominster, Mass.

OTHER TRIBUTES TO CHARLES A. BENNETT

The active life of Mr. Bennett came to a close on Wednesday, June 17, 1942, and with its ending another of the pioneers of American education has gone. His many friends will miss his presence and counsel in the various groups and organizations of which he was a quiet, but moving spirit. While the past few years of a lifetime of nearly fourscore years were spent in comparative retirement due to his physical condition, he was actually busy to the very last day.

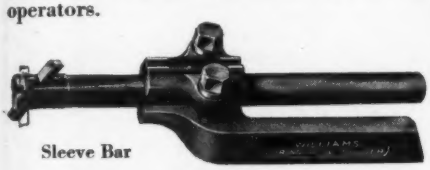
(Continued on page 18A)

HOW AND WHY
WILLIAMS' TOOLS AID WAR PRODUCTION

J. H. WILLIAMS & CO., *Drop-Forgings and Drop-Forged Tools*, BUFFALO, N. Y.

DATA ON WILLIAMS' BORING TOOLS

For those lathe operations involving boring and internal threading, Williams' Tools incorporate certain features which tend to conserve man-hours, improve output, and to reduce the number of rejects, particularly with semi-skilled and inexperienced operators.

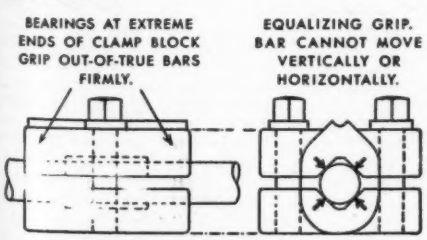


Sleeve Bar

Plain Bar

Williams' Series 80 Boring-Tool Holder

Williams' Boring-Tool Holders (80 series) are designed so that *each* holder will accommodate *several* sizes of bars and so that commercial forms of bar steel are adaptable for either bars or cutters without machining. Adjusting sleeves or bushings are not used with this holder so there are no loose parts to become misplaced or lost. The "V" Block clamping arrangement, sketched below, grips even undersize or out-of-round bars firmly at four points, thus preventing tool chatter.


BEARINGS AT EXTREME ENDS OF CLAMP BLOCK GRIP OUT-OF-TRUE BARS FIRMLY.
EQUALIZING GRIP. BAR CANNOT MOVE VERTICALLY OR HORIZONTALLY.

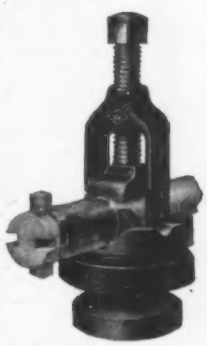
Simplicity of design and sufficient stability to assure freedom from tool chatter are essential features in Tool-Holders for war production.

The Sleeve Bar regularly furnished accommodates either a straight or angle cutter in the *one* head, so there is no extra head to be misplaced while the other is in use. A Plain Bar, as illustrated above, can also be supplied if specified. Series 80 Holders are made in 5 sizes covering bar diameters from 3/16" to 1-1/8".

Williams' Light Boring-Tool Holder

For tool room use and all small work—including turning, as well as boring and threading—Williams' Light Boring Tool Holder incorporates certain distinctive features. In boring and internal threading operations each holder will take several sizes of bars. Easy, rapid adjustment is assured with the knurled adjustment screw. When used as a Turning Tool Holder the offset shank makes it reversible for right and left hand work. This Holder is made in 3 sizes accommodating bars from 1/8" to 7/16" in diameter.

Williams' Adjustable Boring-Tool Post

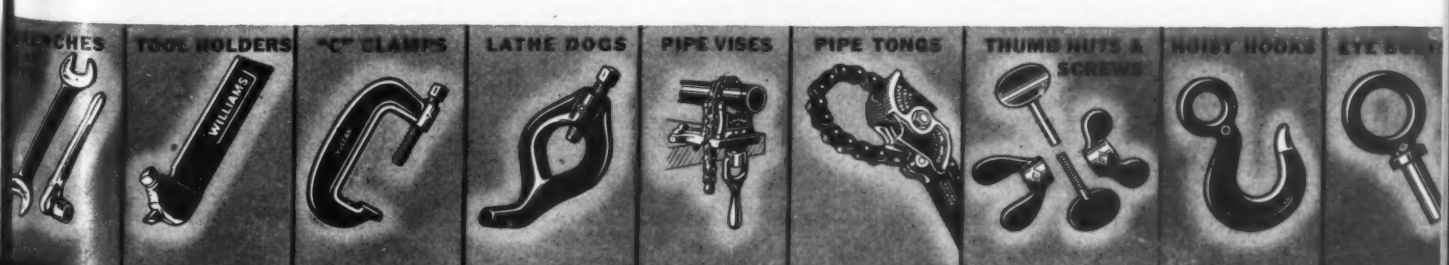


The Williams' Adjustable Boring-Tool Post, with its long range center adjustment, is designed to accommodate many sizes of bars on various types of lathes. Easy, quick, vertical adjustment is accomplished by first selecting the proper bar recess in the slotted collar and then rotating the knurled ring which raises or lowers the bar to the correct height. Tightening the set screw in the head of the post tightens the whole device instantly, giving an extremely rigid tool. For all phases of boring and internal threading this vertical adjustment permits proper centering rapidly and assures perfect performance. The "V" block bar clamping construction grips the bar at four points which eliminates vertical or horizontal movement, thus preventing chattering.

Made in 4 sizes for bars 1/2" to 2-1/4" diameter.

WILLIAMS
SUPERIOR DROP-FORGED TOOLS
Headquarters
for over half a century for
DROP-FORGINGS and DROP-FORGED TOOLS

Sold by Leading Industrial Distributors Everywhere



Filing Hints to meet war-time needs

How to take care of files

(PART I)

IN TEACHING the shop-worker how to take good care of his files, the following practical tips will prove helpful:

Use file of right length, shape and cut for the job.

Be sure material to be filed is securely fastened. Loose work permits chatter, and distorts tooth edges.

In placing the handle on the tang of the file, do not hit the end of the file to drive it into the handle. Push handle on, hold point up, tap handle on bench.

Do not exert undue pressure while filing; but keep the file engaged in the cut to avoid glazing, which destroys the keenness of the teeth.

Raise file slightly during return stroke on hard metals to clear work and prevent wearing away backs of teeth.

On completing job, do not throw the file on the bench. Teeth will be chipped by rough handling. Files have to be hard, hence are brittle.

In filing saw teeth, the sides of the file should be twice the width of the tooth in order to get full filing service of the three sides of the file.

Hard spots and hard corners on iron castings are hard on files. On such work, go over it a few times first with an old file before using your good file.

(To be continued next month)

"MORE CUTS WITH NUCUTS"
means faster, easier filing

Because of the exclusive "Wavy Teeth" design, a NUCUT has both coarse teeth and fine teeth, placed in patented wavy rows. The coarse teeth cut clean, deep, true; the fine teeth level the surface off smooth. Both at the same stroke! This makes NUCUT the fastest-working file obtainable.

HELLER BROTHERS COMPANY
America's Oldest File Manufacturers • Newark, N. J. • Newcomerstown, Ohio

HELLER NUCUT WAVY TEETH FILES

PATENT No. 2027039

Charles A. Bennett

(Continued from page 320)

His life and interests were many sided. He was an effective teacher, a keen writer, editor and historian, a leader with a vision, an artist, a citizen, and friend of youth.

His many contributions to education will remain to guide and inspire those who must carry on. His personal library was placed in the Library of Bradley Institute and so the Bennett Collection will serve students through the years to come. His guidance to young men as prospective teachers, and as contributors to the literature of Industrial Arts, or in the various educational organizations was an inspiration and a challenge to carry on.

— Albert F. Siepert

In the passing of Mr. Bennett, the field of Industrial Arts in the United States has suffered the loss of a great man.

Without fear and without prejudice, immune to vanity, ambition, or envy, he carried on the great pioneering work of establishing the field of industrial arts as a necessary part of general education.

One of the outstanding activities of Mr. Bennett's life was the contribution he made to the elevation of the work of the school-shop teacher to that of a profession in the field of education. The loss of Mr. Bennett will be keenly felt by those who were his co-workers in this endeavor.

The new generation of industrial-arts teachers will miss the personal touch of a teacher of unusual kindness and understanding, as well as the wisdom of a scholar and the learning of a gentleman.

Through his long and untiring industry, Mr. Bennett left behind much of his wisdom, scholarship, and philosophy in books and articles, which will ever be a guide and inspiration to teachers who follow in the field of industrial arts.

— James McKinney

Personal News

DEATH CALLS WILLIAM C. WOOD

William C. Wood, well-known supervisor of industrial arts in Davenport, Iowa, died May 26, 1942.

Associated with the Davenport school system for more than 20 years, Mr. Wood was regarded by those who knew him as one of the outstanding educators in his field in the middlewest. He had charge of activities at the industrial-arts building on the high school campus and also at the three intermediate schools.

William C. Wood

Under his direction, the industrial apprenticeship program was designed to solve the problem of training men for industry in Davenport. The program has since been copied in several manufacturing centers. He also was in charge of the National Defense Training Program when it was established, and was director of the part-time school as well as serving as head of the child labor administration in Davenport.

Mr. Wood was born April 24, 1881, in LeMars, Iowa, and obtained his early education in public schools of that city. He later attended Western Union College and the Iowa State Teachers College and did graduate work at the University of Colorado, the Colorado State College, the University of Illinois, and the University of Wisconsin.

From 1907 to 1909 Mr. Wood was principal of the Volin, S. Dak., high school and for the following two years taught manual training and science at Columbia, Mich. In 1910 he became a member of the faculty at Geneseo, Ill., high school, and in 1912 he went to Sioux City, Iowa, where he was in charge of the industrial-arts program until 1918. He came to Davenport in 1920 and had been connected with the public school system of that city since.

Mr. Wood was affiliated with the National Educational Association, the American Vocational Association, and the Scott County Teachers Association, and was past president of the Iowa State Industrial-Arts instructors. He also was a member of Epsilon Pi Tau, national industrial-arts fraternity.

In 1938 he was chosen by the Iowa State Teachers College as the most typical graduate and one of the most outstanding alumni acting as supervisor in Iowa schools.

(Turn to page 20A)

LET'S GO! U.S.A.
KEEP 'EM FLYING!
ALL LATHE OPERATING FUNDAMENTALS ARE QUICKLY TAUGHT ON THE MODERN ATLAS
SHAPING PRINCIPLES ARE THOROUGHLY UNDERSTOOD AFTER A COURSE ON THE COMPACT ATLAS SHAPER
ATLAS ENGINEERS DEVELOPED THE FIRST COMPACT LOW COST MILLING MACHINE

Atlas EQUIPMENT

AT NATIONAL SCHOOL of AERONAUTICS INC.

Helps Give Quick, Thorough Training To Airplane Mechanics

"Keep 'em Flying" is the vital job of everyone today in the battle behind the lines. And supplementing the fine work of vocational schools and instructors throughout the nation are the shops of the various armed services at key centers. A typical training set-up is partially shown above — the Army Division of the Machinists School of the National School of Aeronautics, Inc. Here complete practical instruction is given on some twenty Atlas 10" Lathes, ten Atlas Shapers, eight of the new Atlas Milling Machines, and many other Atlas Tools.

Whatever the needs of your training program, there's an Atlas Machine Tool capable of providing reliable experience in all the operating fundamentals. And it's quite probable that your students will be given Atlas Equipment to run when they get into war production or war maintenance work. We will be glad to send you promptly complete information about compact Atlas Equipment.

INVEST IN U·S· WAR BONDS AND STAMPS

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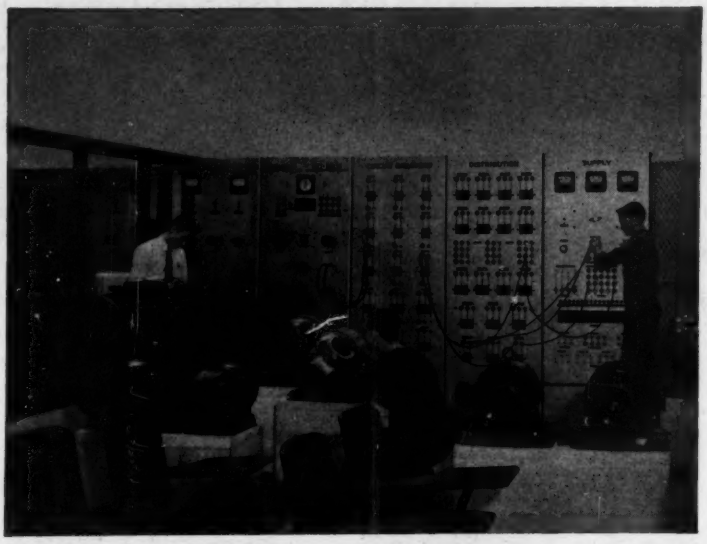
ATLAS PRESS CO., 971 N. PITCHER ST., KALAMAZOO, MICH.

LATHES · DRILL PRESSES · ARBOR PRESSES · SHAPERS · MILLING MACHINES

Helping You Answer Industry's Call for Technicians



STANDARD TEST AND DISTRIBUTION PANELS

make electrical instruction more efficient . . . more interesting

These are days when every hour of technical training must be stretched! Standard Test and Distribution Panels help you conserve precious time by making your electrical instruction more effective — easier to teach — more interesting.

Standard Panels provide maximum circuit and operating flexibility, speed in connection changes. This equipment is equally useful for elementary and advanced instruction. Panels are modernly designed, substantially built for years of service. Their cost is reasonable. Offered in a wide range of models for all classifications of shops and laboratories. A Standard Field Engineer will gladly bring you practical suggestions. Literature on request.

"Standard Makes Every Minute Count"

THE STANDARD ELECTRIC TIME COMPANY

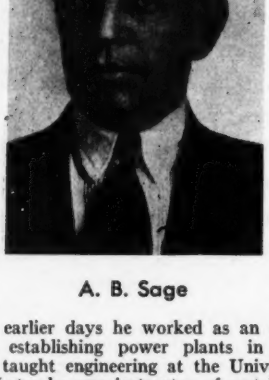
79 LOGAN ST., SPRINGFIELD, MASS. BRANCH OFFICES IN PRINCIPAL CITIES

(Continued from page 18A)

DEATH OF A. B. SAGE

A. B. Sage, who was widely known among the shop teachers of the West, Southwest, and South, died on July 7, 1942, at the age of 68.

He earned his master's degree at the University of New Mexico, but also did work at a number of other well-known universities.



A. B. Sage

In his earlier days he worked as an electrical engineer, establishing power plants in Mexico. Then he taught engineering at the University of Mexico. Later he was instructor of metalwork in Gary, Ind.

As a member of the Federal Board for Vocational Education he did organizational work in the southwest. Later he served in a similar position for the state department of education, Tallahassee, Fla.

He was a teacher of industrial education at Miami, Fla., for 15 years, and also taught special adult classes at the University of Miami.

He died at the Memorial Hospital, New York City, and was buried in Wheeling, W. Va.

♦ WILLIS H. UMBERGER has been appointed as superintendent of schools in Old Lyme, Conn.

♦ LAURENCE A. HILL, head of vocational department, Schoolfield High School, Schoolfield, Va., has recently accepted a position with the Virginia State board of education as regional supervisor of defense training in western Virginia. Mr. Hill holds a B.E. degree, 1932, from Eastern Illinois State Teachers College, and an M.S. degree, 1936, from Iowa State College.

♦ JOHN H. THORP, who has been teaching a summer course at New Britain State Teachers College entitled "Curriculum Construction in Industrial Arts," resigned as superintendent of schools in Old Lyme, Conn., to become supervisor of industrial arts for the state of Connecticut. He will be stationed at Hartford, Conn.

He is a graduate of the Stout Institute and holds an M.S. degree from the University of Wisconsin.

♦ DR. ROYAL B. FARNUM, executive vice-president of Rhode Island School of Design, today announced the decision of the board of trustees to offer henceforth the bachelor of science degree in fields offering majors in art education, industrial-arts education, machine design, general textiles, and in textile chemistry; and the bachelor of fine arts degree in architecture, design, painting, and sculpture.

♦ MURRAY BANKS, supervisor of distributive education for the public school system, Millville, N. J., was recently awarded a doctor's degree in vocational education by New York University.

♦ R. H. SIMMONS, head of the educational service department of Behr-Manning, Troy, N. Y., has been inducted in the armed forces of our country. He has received the commission of ensign in the U. S. Naval Reserve.

♦ JEROME LEAVITT, for the past four years on the staff of the Heights Elementary School, Roslyn Heights, N. Y., has been appointed as teacher of the oldest group of children in the Manhattanville Play School.

This is a demonstration school of the Play Schools Association whose program furnishes all-day care for children of every nationality and creed from the near-by neighborhood.

♦ JAMES A. SHUCK, who has been connected with the Owensboro, Ky., schools for the past nine years, was elected to the position of co-ordinator to have charge of the Technical High School during the absence of C. F. Criley, principal, who left recently to enter the service. The Technical High School will operate on a 24-hour basis during the summer months with defense classes in session.

♦ WILLIAM J. BECKER has resigned his position as instructor of industrial arts in the Ithaca public schools, Ithaca, N. Y., to take over the work of supervising vocational rehabilitation in the New York State Education Department at Albany.

♦ EARLE D. BENNETT, formerly director of Vocational Education, Tacoma, Wash., is now director of WPB In-Plant Training, at the Seattle-Tacoma Shipbuilding Corp., Tacoma, Wash.

♦ W. A. BRAZIER, teacher at the Milwaukee Vocational School, and former secretary of the Wisconsin Vocational and Adult Education Association, has been released to act as consultant in Foremanship Training at the NYA headquarters, Washington, D. C.

♦ HOMER C. ROSE has been appointed to the staff of the Armored Force School, Fort Knox, Ky. Just previous to his appointment Mr. Rose was a member of the faculty of the Southern Illinois State Normal School, Carbondale, Ill.

♦ DALMOR H. JAMES, teacher of machine-shop practice and mechanical drawing in the Union

(Continued on page 23A)

(Continued from page 20A)

High School, Bishop, Calif., was elected mayor of Bishop. He has served on the city council for several years.

♦ CHARLES H. SECHREST, industrial-arts teacher at Ferry School and directing teacher, Wayne University, Detroit, Mich., recently received the degree of M.Ed. from the Wayne University.

♦ DALE PETERSON, who was recently inducted into the U. S. Army, was a teacher of woodwork and hobbies at Irving High school, Salt Lake City, Utah, prior to his entry into the service of our country.

Association News

♦ Psi Chapter of Epsilon Pi Tau was established under the sponsorship of Anthony T. Stavaski, at the State Teachers college, California, Pa. The formal initiation and banquet were held at the George Washington Hotel, Washington, Pa.

Among those performing the initiation ceremonies were:

Glenn E. Best, director of industrial arts, West Virginia Institute of Technology, Montgomery, W. Va., and sponsor of Upsilon Chapter;

John J. Hatch, director of fine and industrial arts, State Teachers College, Newark, N. J., and sponsor of Omicron Chapter;

Dr. Shriver L. Coover, director of industrial arts, State Teachers College, California, Pa.;

George C. Decker, director of industrial arts, State Teachers College, Buffalo, N. Y., and Cosponsor of Tau Chapter;

Dr. Burl N. Osburn, director of industrial arts, State Teachers College, Millersville, Pa. Epsilon Pi Tau, Charterer;

Anthony T. Stavaski, graphic arts department, State Teachers College, California, Pa.;

James O. Stephan, professor of industrial arts, Ohio University at Athens, Ohio. Cosponsor of Lambda Chapter; and

Dr. William E. Warner, professor of education, Ohio State University, Columbus, Ohio, and national secretary of Epsilon Pi Tau.

The 22 initiates were: Dr. Robert M. Steele, president of State Teachers College, California, Pa.; Mr. Arthur W. Bauer, Mr. William B. Cole, and Mr. Aaron J. Hoover of the industrial arts faculty; Levan J. Hill, Altoona, chairman of the petitioning committee; Ralph Charney, Fayette City; William Etsweiler, Jr., Millersburg; Michael and Stephen B. Kuzma, Leetsdale; Kenneth I. Lutz, secretary, Perryopolis; Donald E. Moon, treasurer, Connelsville; Jacob Schoeppler, Beaver; Alexander J. Smoyer, Clairton; William C. Stuckrath, president, Pittsburgh; Edmund Robertson, Clairton; Leonard H. Rothermel, Ambridge; George R. Wist, Baden; and James D. Wolfe, Irwin.

Guests of Psi Chapter were Dr. Thomas M. Gilland, director of teacher placement and student teaching, State Teachers College, California, Pa.; Mr. Robert M. Keck, professor of industrial arts, and Mrs. Keck; Miss Rose Leacock, industrial-arts faculty; and Dr. Theodore A. Siedle, dean of instruction, and Mrs. Siedle.

Many of the nation's leading educators in industrial arts and vocational education were present at the banquet. Dr. Burl N. Osburn was toastmaster and Dr. William E. Warner presented the charter to Psi Chapter with Paul N. Walker, director of activities at California, accepting the charter for the chapter. Keys were presented to the new members by Dr. Shriver L. Coover. Also present were I. K. Vandam of Bakersfield, Calif., and Joseph Petta of Fort Worth, Tex., both of whom are doing graduate work toward their doctorate at Ohio State University.

As a climax Dr. Warner presented the laureate award to Dr. Robert M. Steele, president of the State Teachers College, California, Pa.

—Kenneth I. Lutz

(Continued on following page)

Backing Up the Men At the BATTLE STATIONS

This picture shows Starrett Tool users at the Goss Printing Press Co. working on heavy caliber anti-aircraft guns for the U. S. Navy — a job that has already won the coveted Navy "E."

Teaching your boys to appreciate fine precision measuring tools and to make the most of them is the finest service you can render, both for the immediate future and the better days that lie ahead.

HAVE YOU SEEN THIS BOOK?

The Starrett Book for Student Machinists has been prepared in cooperation with leading vocational school and shop training instructors. Contains the kind of practical, useful, up-to-the-minute information about tools, machines and modern metal working methods your boys must know today. Available through your Starrett Tool dealer at only 75 cents per copy.

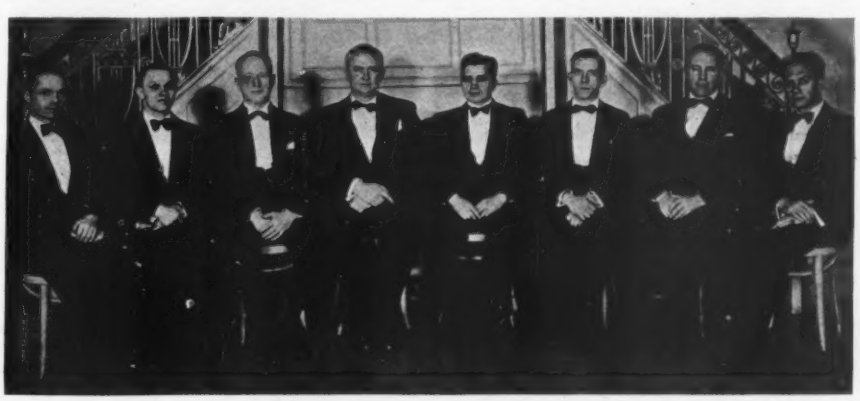
THE L. S. STARRETT CO.

World's Greatest Toolmakers

Precision Tools . Dial Indicators . Ground Flat Stock . Hacksaws . Metal Cutting Bandsaws . Steel Tapes

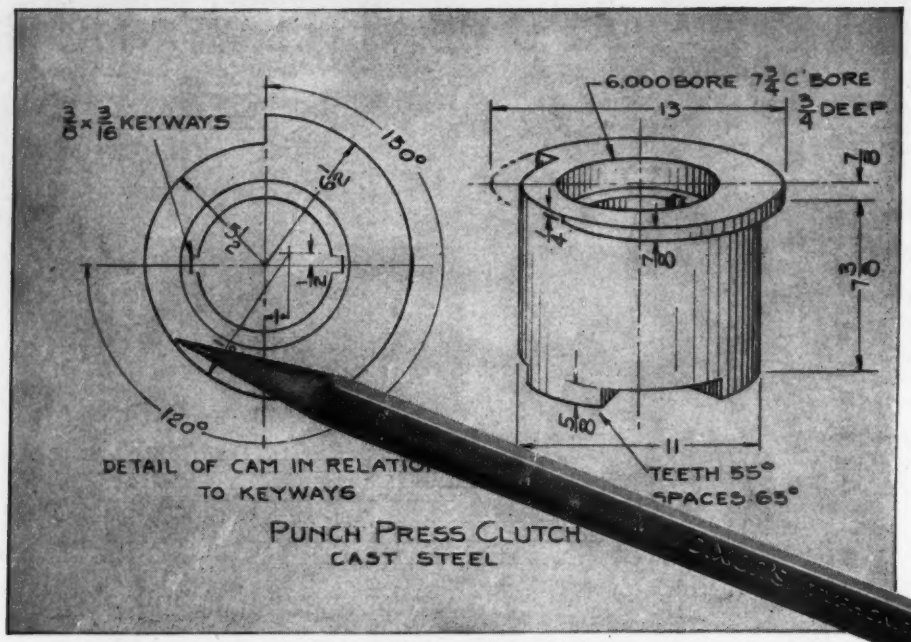
ATHOL MASSACHUSETTS U. S. A.

STARRETT TOOLS



Installation of Psi Chapter of Epsilon Pi Tau at State Teachers College, California, Pa.

A NEW PROBLEM FOR YOUR YOUNG DRAFTSMEN!



Puzzled as to what assignment to give your students? Why not start them off with this problem? Ask them to draw the correct orthographic views.

And remember, you get out of a blueprint exactly what you put into the drawing! That's why it's a good idea to start from scratch using *Typhonite* ELDORADO. This great professional pencil brings out the best work in each student; its smooth, opaque lines come clean . . . produce results of which both you and your class may well be proud.

PROBLEM: Ask your students to draw the correct orthographic views of this Punch Press Clutch. *Typhonite* ELDORADO degrees recommended: 3H and 4H.

SOLUTION: We'll send you a free blueprint showing the problem's solution if you write to address below within 30 days, specify Blueprint No. 128-J9.

SCHOOL BUREAU, PENCIL SALES DEPT.
JOSEPH DIXON CRUCIBLE CO.
JERSEY CITY, N. J.

Initiates at the installation of Psi Chapter of Epsilon Pi Tau at State Teachers College, California, Pa. See page 23A

(Continued from previous page)

♦ At the annual vocational conference of the Pennsylvania Vocational Association held at Eagles Mere, Pa., on June 25–27 the following officers were elected for the ensuing year: president: Leroy Quay, vocational teacher and coordinator, Williamsport Technical Institute; vice-presidents: agriculture — T. M. Malin, county agricultural adviser, York; home economics — Miss Emma Watts, county home-economics adviser, Pittsburgh; trade and industrial — Hugh Roberts, admissions supervisor, Pennsylvania State School of Aeronautics, Harrisburg; industrial arts — Benjamin C. Cooke, industrial-arts teacher, Swathmore; secretary-treasurer: F. Theodore Struck, The Pennsylvania State College, chairman, Business Education Group.

♦ The Michigan State Convention of the Future Craftsmen of America was held at the Durfee Intermediate School, Detroit, Mich., on Saturday, May 9, 1942.

The first general assembly was held at 9:30 a.m. Don Carter of the Denby High School Chapter presided at this meeting. Mr. Irvin Van Tassell, principal of the Durfee Intermediate School, extended a welcome. The opening and closing ceremony of the F.C.A. was put on by the boy officers of the Durfee Chapter.

At 10 a.m. contests were held in the following crafts: drafting, auto starting, public speaking, printing, electrical work, model yacht, machine shop, model aircraft, photographs, radio, woodworking, and wood turning.

These contests were held in both the junior and senior divisions. Over 75 boys from the seventh, eighth, and ninth grades participated in the junior divisions. The senior divisions were well represented.

The luncheon meeting was attended by 150 boys and sponsors. Don Stoddart, retiring president, was the toastmaster.

Earl L. Bedell, director of vocational education, Detroit, gave an inspiring address on "Practical Arts in American Life."

A. D. Althouse, supervisor of vocational education, Detroit, then presented the loving cup to the schools of the craft contest winners.

At the meeting of the delegates the following officers were elected to represent the state of Michigan:

Senior officers: president, Don Carter, Denby High School; vice-president, Otto Rose, Cass Technical High School; secretary-treasurer, Nick Medvid, Cass Technical High School.

Junior officers: president, Morris Pletz, Hutchins Intermediate School; vice-president, Wm. Campbell, Wilson Intermediate School; and secretary-treasurer, Jim Sherman, Durfee Intermediate School.

Tappan Intermediate School was chosen as the headquarters for the 1943 convention.

At the June meeting of the Brooklyn Guild, Teachers of Shopwork of New York City, held

(Continued on page 26A)

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Dumore PRECISION Grinders

(Continued from page 24A)

at the Brooklyn Technical High School, John M. Hurley, vice-president of the guild, gave an excellent talk and demonstration on silk-screen printing.

At the business session the following officers were elected for the coming year: president, Ferd. P. Erdin; vice-president, John M. Hurley; financial secretary, William Davis; recording secretary, Sol Kelman; corresponding secretary, Louis R. Krassner; and treasurer, Albert J. Weissenberg.

♦ FRED W. MILLER, director of the Masonic Home School of Printing at Fort Worth, Tex., was elected president of the National Association for Printing Education. Elected as vice-president is Harold G. Crankshaw, printing instructor at Central High School in Washington, D. C., and Staley Berryman, printing instructor at Evansville High School, Evansville, Ind., is treasurer.

Retained as executive secretary is Floyd C. Larson, composing-room superintendent of the Masonic Home School of Printing at Fort Worth, also editor of the official monthly magazine, *National Printing Education Journal*.

The organization completed its first fiscal year in July and at that time had a membership of nearly 300. Memberships for the coming year are now being accepted from persons engaged in printing education and from those people in the printing and allied trades who are actively interested in graphic-arts education.

Under the new constitution set for adoption this month the organization will be managed by its officers and a group of 15 district representatives which will compose the board of directors. Representation of every printing educator in the nation and democratic participation in all group affairs is the organization keynote.

Fifteen of the nation's leading printing educators and administrators head the board of directors and committees: George T. Hart, Rochester, N. Y.; Clifford W. Hague, Fitchburg, Mass.; Ward T. Swain, Pittsburgh, Pa. (Professional Problems Committee); Harold G. Crankshaw, Washington, D. C. (Cooperation Committee); Everett V. Harris, Atlanta, Ga.; R. Randolph Karch, Cincinnati, Ohio; William R. Baker, Menominee, Wis. (Nominating Committee); John C. Tranbarger, Terre Haute, Ind. (Research Committee); Harold E. Sanger, Chicago, Ill. (Finance Committee); Kenneth L. Elliot, Little Rock, Ark.; Leroy Brewington, Pittsburg, Kans. (Membership Committee); Edwin B. Harding, Brookings, S. Dak.; Ralph T. Bishop, Greeley, Colo. (Employment Survey Committee); Allison J. McNay, Los Angeles, Calif.; and William E. Warner, Ohio State University, will be chairman of the Educational Standards Committee.

The board of directors named its chairman at the first annual business session at Grand Rapids at the same time the International Association of Printing House Craftsmen held its convention. Founders of the National Association for Printing Education are all prominent craftsmen in their communities, and much expense will be saved by holding annual meetings at the same time and place as the International Craftsmen.

♦ At a meeting of the Massachusetts Industrial Education Society on April 7, a resolution was adopted favoring deferment under the selective service system for industrial-arts instructors. More than 250 executives, teachers, and administrators attended the conference at Fitchburg State Teachers College.

Declaring that industrial arts were essential to the national defense effort, the resolution was adopted following a committee report. Other resolutions included one favoring developing industrial-arts programs in public schools and the appointment of a steering committee.

Featuring the afternoon session was a discussion on "Industrial Arts and Model Airplanes," led by M. Norcross Stratton, assistant state director of vocational education, and Ellroy W. Bollinger of New York. A large variety of model airplanes, made in schools throughout the commonwealth as part of a federally sponsored project, were displayed. It was reported 18,000 models would be built by Massachusetts before June.

A round-table discussion on administrative problems featured the morning session, with Superintendent of Schools E. C. Grover of Reading, and Superintendent Quinn of Winchester participating. Instruction problems were discussed at another round-table led by Edward H. Temple of Mechanic Arts High School, Boston.

♦ The Kentucky State Industrial Arts Association met in Louisville, Ky., April 17, as a regular associated group of the Kentucky Education Association.

At noon approximately one hundred members sat down to a luncheon in the Colonel's Room of the Kentucky Hotel. Immediately after the luncheon, Edwin B. Hundley, Louisville, vice-president of the association, and acting chairman at the meeting, asked the members to bow their heads in silent prayer in memory of the men in the armed services who have thus far lost their lives so nobly defending our country.

Mr. Leonard Daugherty, supervisor of industrial arts, Louisville, was then called on to introduce Mr. Paul Harris, co-ordinator of defense training, Louisville area, who spoke on defense training.

David M. Wherry, Dayton, then introduced Dr. R. E. Smith, Ohio State University, whose subject was "The Future of Industrial Education. Shall it be More or Less?"

At the business meeting the following officers were elected to serve for the ensuing year: Edgar E. Mara, Covington, president; Stanley Kozarski, Danville, vice-president; Eivind O. Eikin, Louisville, secretary-treasurer; and Edwin B. Hundley, Louisville, and Harvey K. Meyers, Richmond, committee members.

— *Edgar Mara*

♦ Mu Sigma Pi Fraternity sponsored a breakfast during the recent Michigan Industrial Education Society Convention in Detroit. It was held in the Casino Barracks at the Book-Cadillac Hotel. Reveille took place at 7:30 sharp. The colors were presented and the National Anthem

(Continued on page 28A)

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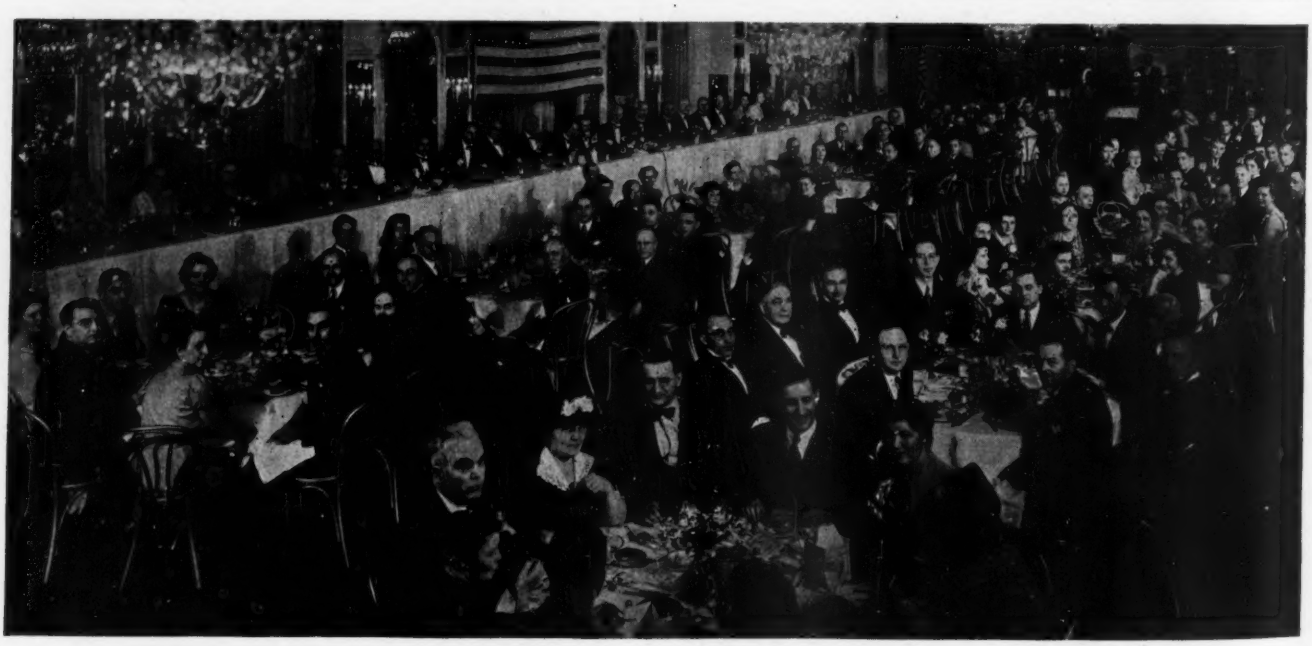

Michigan Industrial Education Society Banquet 1942

was sung by 50 first-class privates. O. Frank Carpenter, principal, Wilbur Wright Vocational High School, served as the officer of the day. Dr. W. E. Lessenger, dean of the College of Education, Wayne University; Dr. Warren E. Bow, deputy superintendent; Earl L. Bedell, director of vocational education; Dr. Charles Anspach, president of the Central Michigan College of Education; and Carl E. Karlstrom, supervisor of vocational education and president of the Michigan Industrial Education Society were seated at the table for the Honorary Cavalry Pilots and the Brass Hats. Mr. S. B. Steers, Michigan Commander of the Civil Air Patrol, gave an interesting bombardment regarding the activities of the air patrol. The committee consisting of George Peacock and Gerald Baysinger was court-martialed before the orderly retreat.

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A new instructional manual for beginners presenting a series of operational units, accompanied by units containing the necessary technical information for later application in selected jobs. The most commonly used charts and tables for the lathe operator are included within. The *operation units* give concise yet detailed, step-by-step presentation of how to perform each lathe operation. Each operation is illustrated by photographic close-ups of specific steps. *Job sheets* in blueprint form give the student an opportunity to read technical drawings and to apply the information he interprets from the drawings to actual work on the lathe. These jobs involve all of the basic lathe operations and can be built from standard low-cost stock.

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A text-workbook combination that directs the student to various types and standards of measurement used in industry; to give him a knowledge and understanding of the best recognized theory and procedures in measuring methods that he will encounter on the job; and to provide definite operational exercises that direct the student's practice in making accurate, exact measurements. This instruction and practice covers lineal measurements and other properties of material that are constantly being measured, such as temperature, density, specific gravity, and tensile strength. Objective tests for various phases of the course and a comprehensive test covering the entire unit give the student an opportunity to check his learning accomplishments. The tests are not bound with the book.

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A blueprint reading procedure for the machine trades. It presents actual blueprint reproductions, taken from actual machine operations, for interpretation by the student. Thirty-nine *problems* range in difficulty from the simple *notched block* to complex drawings of *gun parts* and an *air-cooled engine*. The student gains experience as he determines dimensions, materials used, and methods specified by the blueprint reading problems of this procedure. The Instructions, Explanations, and Questions are bound separately (in Part I) from the Blueprints (in Part II) which are used up as the student completes his work. Part I in this way may be used over and over again by successive classes, affecting considerable economy.

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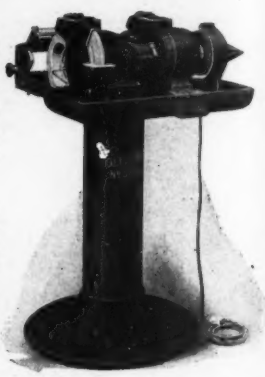
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A.: Abandon all ideas of using luminous paint on the bodies of boys acting in physical education demonstrations.

First, all materials used for such purposes are poisonous in their reaction when in contact with the skin.

Second, since phosphorous and radium compounds would be the only practical type to use, common sense alone would take them out of the picture.

Third, fluorescent painted surfaces require a source of near-ultraviolet light to be activated or visible during darkness.

Fourth, you could not get the raw materials at any price now since all available types have been taken over by the army for the manufacture of glow instruments and markers for night maneuvers.

If you really want to make a good stunt out of your night demonstration, figure out some way to put tiny spotlights on heads, feet, and fingertips wired to belt batteries in such a manner as to avoid interference in the various postures of your demonstrators. — *Ralph Waring.*

New Publications

Operation of Common Woodworking Machines

By Herman Hjorth, M.S. Paper, 163 pages, 7¾ by 10 in., illustrated. Price, $1.72. Published by The Bruce Publishing Co., Milwaukee, Wis.

This book is especially written for the beginner who is just starting out to use power tools.

Each separate tool is briefly but thoroughly described. General safety rules for its use are given, and then follows a thorough explanation of how the tool can be used for doing the various operations for which it was designed.

The illustrations clearly emphasize the points which the author wishes to bring out.

The following machine tools are covered. The circular saw, band saw, jig saw, jointer, planer, hollow-chisel mortiser, shaper, router, drill press, sander, and the lathe.

A special chapter is devoted to the sharpening of these tools.

Aircraft Riveting Fundamentals

By George E. Tabraham. Paper, 31 pages, 8⅜ by 10⅝ in., illustrated. Trade price, 50 cents; school price, 32 cents. Published by The Bruce Publishing Co., Milwaukee, Wis.

The author has packed a great deal of information into this exceedingly practical little book. Into 10 essential jobs he has condensed the information required to train an employable aircraft riveter. The last job is a test to show whether the student has learned all he ought to know before going into industry.

Blueprint Reading for the Metal Trades

By W. A. DeVette and D. E. Kellogg. Paper and cloth, 132 pages, 8½ by 10⅞ in., illustrated. Price — cloth, $2.50; paper, $1.60. Published by The Bruce Publishing Co., Milwaukee, Wis.

An excellent course for all those who work or intend to work in the metal trades. It covers the subject with great completeness. It also contains much related material, and a number of helpful tables on the various types of gears, such as: spur, bevel, worm, spiral, herringbone, and the like.

The blueprint reading lessons are all based on fine examples of industrial working drawings, and each one furnishes an excellent test of what the student has learned.

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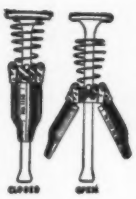

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Metalworking Made Easy

By William J. Becker. Cloth, 135 pages, 6 by 9 in., illustrated. Price, $1.60. Published by The Bruce Publishing Co., Milwaukee, Wis.

This book offers 45 metal projects that possess boy interest both in their design, as well as in the application for which they are intended. The book is well illustrated, and every article is accompanied by terse, but clear, step-by-step directions on how it is to be made.

The book also contains lists of equipment and tools, a description of the tools required, and the finishes to be applied.

Tools of Victory for the Battle of Production

Prepared by the Technology Department of the Detroit Public Library, Detroit, Mich. Paper, 100 pages, plus a 6-page addenda. Price, 50 cents.

This comprehensive list of training materials and technical books was compiled because of frequent requests for information of this kind. It is of special importance now where there is so much demand for books for war production training classes.

Creative Crate Craft

By Paul V. Champion. Cloth, 110 pages, 6⅛ by 9¼ in., illustrated. Price, $1.50. Published by The Bruce Publishing Co., Milwaukee, Wis.

Under present conditions the humble wood containers in which fruit is shipped may become a valuable source of lumber supply for the school-shop and hobbyist.

The contents of this book was written with this thought in mind and, utilizing lumber obtained from such crates and boxes, the author describes and illustrates with half tones and line etchings thirty-five useful pieces of furniture which will serve their purposes very well.

(Continued on the following page)

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TABLE — The table is designed to give years of use while retaining its shape and alignment. The working surface is arranged with generous oil pockets and with three Tee-slots. The table has both power longitudinal and power transverse feeds.

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(Continued from preceding page)

Airplane Models and Aviation

By Willis C. Brown. Paper, 43 pages, 12 by 8⅝ in., illustrated. Price, 48 cents. Published by D. C. Heath and Co., Boston, Mass.

A book for the beginner in which theory and practice are combined in a manner that will delight the student.

Elements of Modern Surface Raceway Wiring

By John J. L. Gross. Paper, 45 pages, 8½ by 11 in., illustrated. Price, $2.50. Published by The Wiremold Co., Hartford, Conn.

This book on the principles of modern surface-raceway wiring installations is intended especially for teachers of electrical work in apprentice, vocational, and trade extension classes.

The second part of the book consists of 29 pages of information and lesson assignments printed on transparent paper so that blueprints may be made for all students taking the course.

Professional Writings of Homer J. Smith

Edited by William J. Micheels. Paper, 89 pages, 8½ by 10¾ in. Price, 50 cents. Published by Industrial Arts Club, University of Minnesota, Minneapolis, Minn.

This book will be found exceedingly helpful and interesting by those engaged in industrial arts and vocational education.

Its helpfulness consists in the fact that it abstracts, quotes, and lists the numerous pieces of educational literature which have come from the versatile pen of Dr. Homer J. Smith, and it is interesting because it portrays not only Dr. Smith's philosophy and reaction to current practices, but also the respect, admiration and love in which this man is held by other educators both in the specialized fields of industrial arts and vocational education, and in the field of general education.

The material was gathered by a committee of workers, and the late Charles A. Bennett wrote the foreword.

Indiancraft

By W. Ben. Hunt. Cloth, 124 pages, 7 by 10½ in., illustrated. Price, $2.75. Published by The Bruce Publishing Co., Milwaukee, Wis.

Another fine selection of 45 articles by an author whose contributions please every boy and man who is interested in the arts and the lore of that true American — the Indian.

Electrical Things Boys Like to Make

By Sherman R. Cook. Cloth, 205 pages, 6¼ by 9½ in., illustrated. Price, $2.25. Published by The Bruce Publishing Co., Milwaukee, Wis.

Into this book the author has crowded 32 novel, yet simple, electrical projects which will interest almost any boy.

The directions are simple and concise, the illustrations excellent, and the choice of projects very interesting.

Trade and Job Analysis

By Verne C. Fryklund. Cloth, 167 pages, 5½ by 8 in., illustrated. Price, $1.75. Published by The Bruce Publishing Co., Milwaukee, Wis.

This book, written by a man who has had practical experiences as a mechanic, who has done considerable teaching of shopwork himself, and who has trained teachers for many years, is a competent aid for those who need to analyze occupations so that a learner may more easily acquire the knowledges and skills which he must have to fit into the industrial world of today.

The simplified method of analysis, as presented by the author, is of special use right now where America is confronted with the huge task of hurriedly preparing men for the war production program which will lead us to victory.

The material is presented under the following chapter headings: Trade and Job Analysis; Modern Industrial Workers; Kinds of Analysis; Identifying Trade Elements; Making the Analysis; Analysis in General Application; Learning and Teaching; Suggestions for Course of Study Building; and Written Instructions.

Master Homecraft Projects

By G. A. Raeth. Cloth, 160 pages, 6¼ by 9½ in., illustrated. Price, $2. Published by The Bruce Publishing Co., Milwaukee, Wis.

This book presents 24 modern pieces of furniture. The book is well illustrated, the method of procedure clearly outlined, and each description is accompanied by a bill of material.

News Notes

♦ A general, practical shop to be used jointly by the senior high and the junior high school students of Anacortes, Wash., is now being built to replace the frame building lost last summer by fire. The building, made of reinforced concrete, is 130 ft. long by 42 ft. wide, and when fully equipped will cost about $30,000.

The full basement will have an auto shop, a metal shop, a janitor's supply room, and space for four 58-passenger buses. The main floor has two woodworking shops and a domestic-science room.

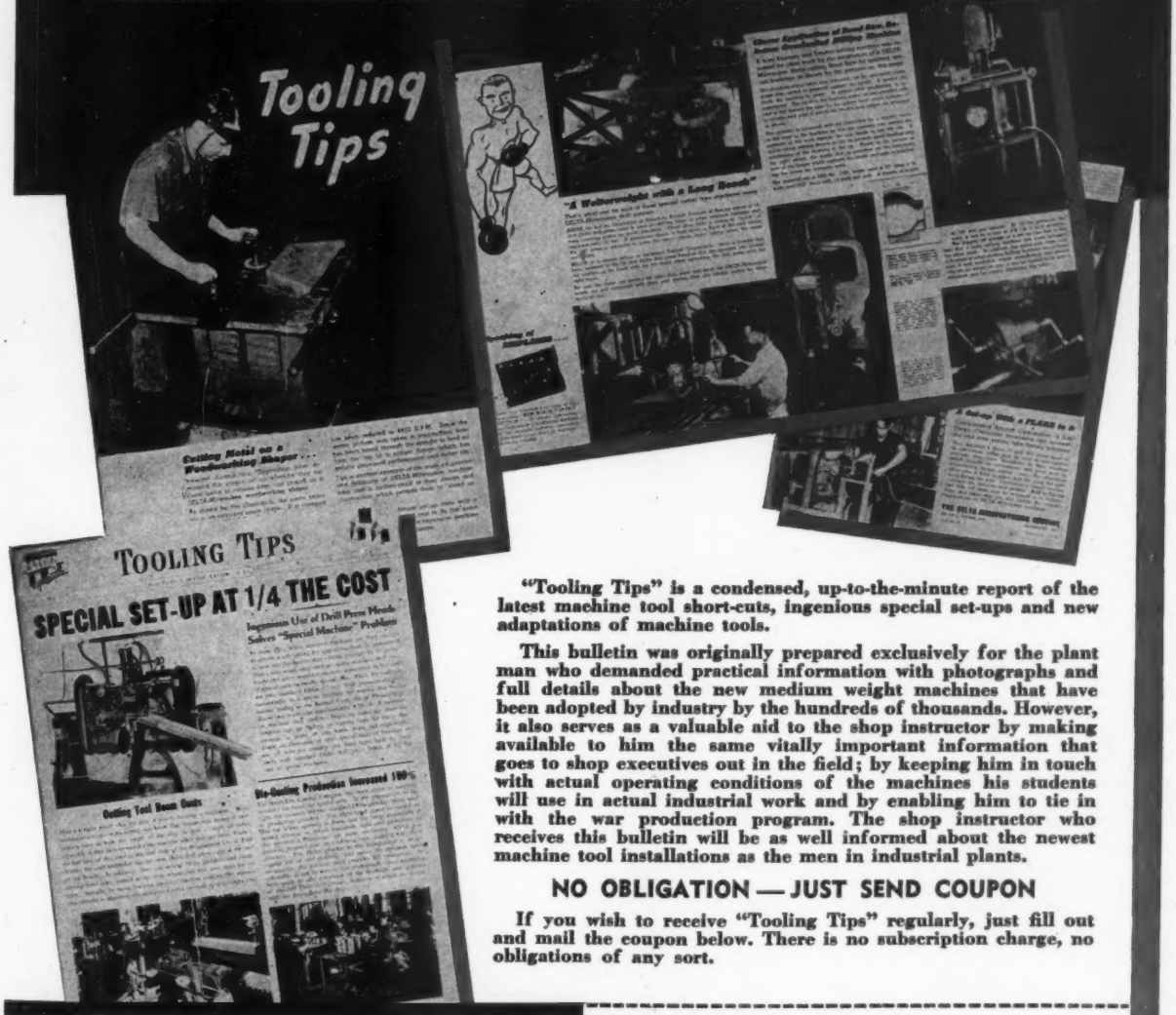
Because of difficulties encountered in obtaining supplies and equipment, it is expected that certain parts will not be finished or fully equipped for two or three years.

♦ Students, teachers, parents, and others interested in industrial chemistry will find helpful information in a six-page leaflet on "Industrial Chemistry as an Occupation," published by Occupational Index, Inc., at New York University. In quantities the price is $5 a hundred. Single copies are 25 cents, cash with order.

This is one of a series of 67 such leaflets describing opportunities in 67 different occupations. Each one covers the nature of the work, abilities and training required, income, and miscellaneous advantages and disadvantages.

(Continued on page 38A)

THIS Practical Shop Bulletin will keep you in touch with latest Industrial Shop Developments



"Tooling Tips" is a condensed, up-to-the-minute report of the latest machine tool short-cuts, ingenious special set-ups and new adaptations of machine tools.

This bulletin was originally prepared exclusively for the plant man who demanded practical information with photographs and full details about the new medium weight machines that have been adopted by industry by the hundreds of thousands. However, it also serves as a valuable aid to the shop instructor by making available to him the same vitally important information that goes to shop executives out in the field; by keeping him in touch with actual operating conditions of the machines his students will use in actual industrial work and by enabling him to tie in with the war production program. The shop instructor who receives this bulletin will be as well informed about the newest machine tool installations as the men in industrial plants.

NO OBLIGATION — JUST SEND COUPON

If you wish to receive "Tooling Tips" regularly, just fill out and mail the coupon below. There is no subscription charge, no obligations of any sort.

DELTA
MILWAUKEE

The Delta Manufacturing Company
660-K E. Vienna Ave., Milwaukee, Wis.

Please place my name on the mailing list to receive "Tooling Tips" as issued.

Name .....

School ..... **Position** .....

Address .....

City ..... **State** .....

☐ Also send me copy of latest Delta Catalog.

CALLING ★ YOUR SCHOOL ★

To An Even Greater

TRAINING PROGRAM

★

The demand for trained workers — men and women — is great. The time short. If your school needs more equipment — more tools — more supplies to play the bigger part every school must now play in this vital school defense training program — Uncle Sam wants you to GET THEM NOW!

★ **Take Advantage of B-G Service**

As America's largest school supply source of defense training equipment, supplies and materials — as National School Distributors for scores of leading manufacturers, we'll see that your requirements get the same, prompt, efficient, complete service that has been identified with the name Brodhead-Garrett for more than 30 years. We ship to schools in all 48 states.

★ **What Are Your Needs . . . Problems?**

Big or little, they're vitally important to the success of your school's part in the national training program. So write, wire, or telephone (DIamond 0248) your requirements — even to the planning of a complete school shop — if necessary, we'll gladly send a representative to confer with you. But . . . ACT NOW!

★ **New Catalog Ready — Send For It!**

If you haven't already received the new 1942–1943 Brodhead-Garrett Catalog featuring over 6,000 items including the famous B-G Soft-Textured, Kiln-Dried Lumber, write for your FREE copy at once.

★

BRODHEAD-GARRETT CO.

"Supplying Defense Training Needs to Schools in All 48 States"

4560 E. 71st St., Cleveland, Ohio

Shop Equipment News

New Products — Publications

NEW SOUTH BEND SMALL TURRET LATHE

A new bench model turret lathe for rapid production to close tolerances on chucking operations or bar work has just been announced by the South Bend Lathe Works. This lathe has a 10-in. swing over the bed and saddle wings, 1⅜-in. hole through the headstock spindle, and 1-in. collet capacity. It is well adapted to second operation work.

South Bend turret lathe

The hand-lever-operated bed turret indexes automatically and has an adjustable stop for each of the six turret faces. The lathe is equipped with both a compound rest cross slide and a hand-lever cross slide, which are interchangeable. The latter is furnished with front and rear tool blocks which provide three tool positions. A quick-change gear box supplies 48 longitudinal power feeds for the universal carriage, 48 power cross feeds for the compound rest cross slide, and 48 thread-cutting feeds, 4 to 224 per inch. The underneath motor drive and back gears deliver 12 spindle speeds, from 97 to 700 r.p.m.

A large assortment of attachments and accessories simplify tooling for specialized work or second operation jobs. For information, write to South Bend Lathe Works, Department K7, South Bend, Ind.

OFFSET PRESSWORK TABLE

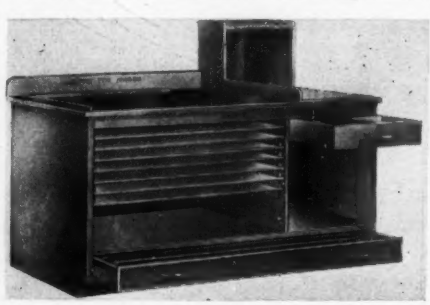
A specially designed worktable and storage cabinet for use with offset presses is now offered by American Type Founders Sales Corp., 200 Elmora Avenue, Elizabeth, N. J.

There is ample working space on top, one end of which is equipped with guides for checking register of printed sheets, and the other end with a plate glass for mixing inks.

There also is a tool drawer with compartment and lock, and a deep drawer for five spare rollers and dampers.

The table is further equipped with seven sliding shelves for packing sheets, press OK's, printed samples, spare blanket, press plates, and the like, and there is a compartment for job tickets, inks, spaces for roller wash-up device and press chemicals.

The table is of wood construction throughout. It is finished in olive-green enamel, black masonite top and shelving. It is available in two sizes — for 17 by 22 press and smaller, and for 22 by 34 press and smaller.



Offset presswork table

BEHR-MANNING SPEED-WET SANDER

The model 12A Speed-Wet sander illustrated herewith has recently been introduced by Behr-Manning, Troy, N. Y.

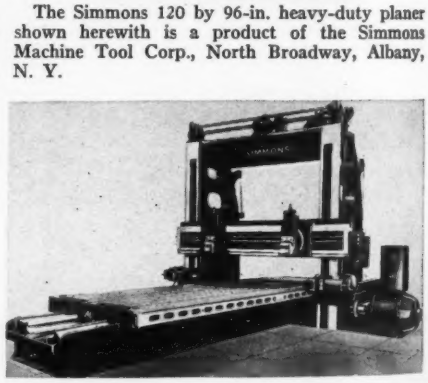
It is a refillable hand-sanding tool. It may be used for dry sanding or with water, gasoline, or oil, on wood, metal, glass, paint and varnish, and on composition.

Speed-wet sander

The tool is provided with a magazine which holds a reserve supply of rolled abrasive paper or cloth, so that fresh sanding surfaces may be moved forward as they are needed.

120 BY 96-IN. SIMMONS PLANER

The Simmons 120 by 96-in. heavy-duty planer shown herewith is a product of the Simmons Machine Tool Corp., North Broadway, Albany, N. Y.



Simmons 120 by 96-in. heavy duty planer

Its special features are forced feed lubrication to the ways, herringbone gear drive for smooth flow of power, power rapid traverse to all heads, double-length enclosed bed, and double-plate box table.

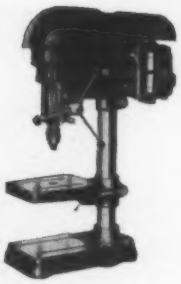
The electrical equipment includes a constant potential reversing motor drive with 50 h.p., d.c., 230 v., 150–900 r.p.m. motor control, giving table speeds of 19 to 115 f.p.m.

SAW SHARPENING CHART

A new comprehensive chart on the proper ways of sharpening handsaws has just been made available by E. C. Atkins and Co., one of the nation's largest saw manufacturers. Especially suitable for use in school shops, the chart facili-

(Continued on page 37A)

THERE ARE MANY BOICE-CRANE POWER TOOLS
FOR MODERNIZING AND EXPANDING YOUR SHOP
Besides THIS FAMOUS HELMET-HEAD DRILL PRESS



EVERY ONE A PRODUCTION-PROVED TRAINING TOOL!

When emergency training of pattern makers and skilled workers skyrockets the need for shop equipment, Boice-Crane can help you. With these very same Boice-Crane tools, industry has already solved many similar problems. Faced with the need for more modern and greatly enlarged facilities QUICKLY, you should get the details of these unusual light machines.

Ideal For Quick Shop Expansion . . Precision Built . . SAFE!

You'll like the thriftiness of Boice-Crane machines. Portable . . . trimmed of excess weight . . . compact . . . they permit extremely flexible shop arrangement. You can actually find space for additional tools for dozens more trainees without adding a foot to your shop. The economical price range spreads program budgets much farther. Operating and maintenance costs are way down.

14" Band Saw
Spindle Shaper
6" Jointer
12" Planer

There's A Difference In Power Tools!

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Bandsaws . Shapers . Lathes
Jig Saws . Jointers . Drill Presses . Sanders . Planers

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BOICE-CRANE CO. 922 W. CENTRAL AVE. TOLEDO · OHIO *Shop Tested* POWER TOOLS SAFETY-ENGINEERED FOR SCHOOLS

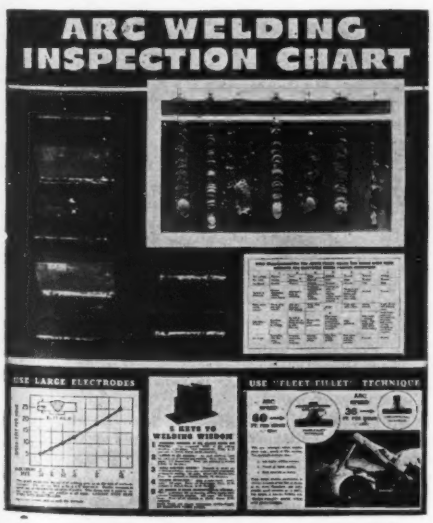
(Continued from page 34A)

tates teaching pupils the correct techniques of putting hand, rip, and panel saws into first-class cutting condition. Large, detailed illustrations accompanied by directions explain each step in the sharpening process. Jointing, filing, and setting are all thoroughly covered.

The chart measures 19 by 25 in. It is printed on medium-weight stock, suitable for wall mounting or framing. Copies of the chart may be obtained free of charge by writing E. C. Atkins and Co., Indianapolis, Ind.

WELD INSPECTION CHART

An arc-welding inspection chart, which provides welding inspectors and others concerned with weld production a simple and extremely helpful aid for use in inspecting welds, has just been published by the Lincoln Electric Co., Cleveland, Ohio.



The chart presents the different types of welds obtained when the work is done normally, with normal current, voltage, and speed, as compared with those obtained when these factors are not normal.

Items to consider in inspection after welding include the size and shape of bead, appearance of the bead, undercut, overlap, and location of craters. A study of the weld and proper interpretation of telltale signs will disclose other conditions of welding.

Accompanying the photographs is a table indicating the burnoff of the electrode, the penetration of fusion, the appearance of the bead and the sound of the arc with each value of current, voltage, and speed of welding.

The inspection chart also illustrates the use of the "Fleet-Fillet" technique of welding, which nearly doubles the normal welding speed. The chart also illustrates how the speed of welding increases as the size of the electrode increases.

The chart is available free of charge to inspectors of welding and others concerned with welding.

MILLING-MACHINE DATA

An 8-page, 8½ by 11-in. catalog listing various types of milling machines has just been published.

Illustrated with pictures, the catalog describes in detail, Bulldog precision milling machines, milling-machine attachments, conversion attachments for lathes, endless belt sanding machines, swing frame grinding and polishing machines, and Gyratory Foundry Riddle.

Jefferson Machine Tool Co., Cincinnati, Ohio.

DELTA BOOKLET

Many timesaving adaptations of low-cost machines to all branches of the armament program are photographically shown and described in an unusual new booklet just published by the Delta Manufacturing Co. Scores of actual shop photographs show the astonishing scope of the penetration of the new type low-cost drill presses, grinders, cutoff machines, abrasive finishing machines, circular, scroll, and band saws. There are numerous pictures of arsenals, aircraft plants, shipyards, foundries, training schools, ammunition factories, and war-production plants of all types showing special setups developed at low cost, batteries of drill presses operated by women and unskilled labor, clever short cuts made possible by these flexible, adaptable machines.

Delta Manufacturing Co., 600 E. Vienna Ave., Milwaukee, Wis.

For brief reference use IAVE—910

PRECISION LATHES

Catalog No. 16, an 8-page, 8½ by 11-in. catalog completely illustrates and describes South Bend 16-in. toolroom lathes and 16-in. quick charge gear lathes. These lathes have 16¼-in. swing, 1-in. collet capacity and are made in several bed lengths providing between centers from 33½ in. to 105½ in. Construction features are illustrated and specifications are tabulated for ready reference.

South Bend Lathe Works, 425 E. Madison St., So. Bend, Ind.

For brief reference use IAVE—914

TOOL MANUAL

"Kennametal Vest Pocket Manual" is the title of a 48-page 3 by 5½-in. manual published for handy reference.

Contained in the manual are chapters on selecting, designing, using, brazing, and grinding Kennametal tools, with easy-to-follow instructions on how to get the utmost service. The manual is further clarified by more than 100 illustrations.

(See Shop Equipment News page 43A)

For The Young Men Who Will Be Our Next Leaders

Central sprayhead of the Bradley gives each student clean running water. Eight to ten can wash simultaneously.

Modern group wash fixtures as used by the thousands in schools and industry—give to each individual the opportunity of washing in clean running water for maximum sanitation.

One Bradley Washfountain cares for eight to ten simultaneously, saves water and space,—reduces time and cost of installation. Instead of 24 to 30 piping connections as needed for eight to ten "single-person" wash basins,—a Bradley to serve the *same* number of washers, *requires only* 3. Much critical metal is conserved, besides which the amount of brass now used in Bradley is only 10% of what was used formerly and the big bowls and pedestals are precast stone or marble, both non-critical materials.

Catalog 4010 will help you plan your washroom—write for a copy. BRADLEY WASHFOUNTAIN CO., 2269 W. Michigan Street, Milwaukee, Wis.

BRADLEY *Washfountains*

AND MULTI-STALL SHOWERS

Below: Bradley Multi-Stall Showers with two Bradley Washfountains at left.

(Continued from page 32A)

♦ An outstanding feature of the summer session program in industrial education at the Pennsylvania State College was a panel discussion in which vocational training with special reference to war industries was discussed. The participating members of the panel were Dr. L. H. Dennis, executive secretary of the American Vocational Association; Mr. Charles W. Sylvester, director of practical arts and vocational education, Baltimore; Mr. E. M. Winslow of St. Johnsbury, Vermont; Dr. Barkas of the Philadelphia public schools; and Professor G. Harold Silvius of Wayne University.

♦ The special courses in industrial-arts training which were conducted in addition to the regular work of the department at Michigan State Normal College, Ypsilanti, Mich., have been showing good results. These intensive courses were offered in an attempt to provide special opportunities for teachers, with suitable background, to qualify for the work of keeping all classes in this field in operation because of their significance in defense training. The courses were opened especially for teachers who have shown interest in practical shopwork, including those who have taught rural school classes, teachers of agriculture or natural science, and teachers of science or mathematics. The work was started June 1, and will continue through to September 1.

♦ One hundred picked Allis-Chalmers Manufacturing Co., employees are taking a 15-week course at the Milwaukee Vocational School, Milwaukee, Wis.

The men devote half their time to machine-shop work, and half to shop mathematics and blueprint reading. Divided into two classes, they attend school two nights a week from 6 to 9 p.m. Similar programs will be worked out for any war-industry plant which can furnish enough workers for special classes.

♦ Appropriations totaling $141,240,000 to be administered by the U. S. Office of Education, were authorized by Congress for war training during the year July 1, 1942, to June 30, 1943, in trade and technical schools and colleges in the United States.

Ninety-four million dollars of this is for the program of vocational education for war-production workers.

Thirty million dollars are for short courses of college grade for engineering, science, and management war training (ESMWT).

Fifteen million dollars are for vocational courses of less than college grade for out-of-school rural and nonrural persons 17 years old and older, for training them to repair, operate, and construct farm machinery and equipment.

One million dollars is to be expended by the U. S. Office of Education for producing and making available visual aids to be used in training essential to the war effort.

One million, two hundred forty thousand dollars was authorized for administrative expenses needed to carry out these programs.

♦ To place itself in a position to most effectively serve the nation's needs, the Iowa State College early this year eliminated the long summer vacation and placed its program on a 12-month basis. Students may enter at the beginning of any one of the four quarters of the year—September, January, March, or June. The fall quarter begins on September 17, 1942. Under this arrangement a student who attends continuously will be able to graduate in three calendar years—a year earlier than if he were to attend only during the period from September to June during each college year. Possibly this is one of the reasons why both the undergraduate and graduate enrollments in industrial education have held up so well this summer. Most likely another reason is that students in industrial education have the opportunity to prepare to teach the work on a general shop basis, unit shop basis, or on a trades and industries basis.

When students come to Iowa State College this fall, they will find themselves part of a college operating at full pace with the war effort. In addition to the regular students, there will be 800 young men enlisted in the navy, training to perform the many and varied duties requiring electrical knowledge on the navy's fighting ships. Dr. T. A. Hippaka and Professor Lowell Carver, as well as several of the industrial education graduates from Iowa State College, including Wayne Dickinson, Edgar P. Swanson, and Leland Benz, are actively engaged in assisting with this important program. This work has been carefully co-ordinated with the regular college program so that both can be carried on with maximum effectiveness.

♦ The Office of Price Administration urges a consumer week for high schools.

In order to implement the suggestion, Consumers Union of U. S. Inc., 17 Union Square, New York City, has prepared a 12-page high school consumer program, with suggestions for activities of consumer clubs, assembly programs, short courses for adults, an information center, a bulletin board, a consumer exhibit, radio programs, special teaching units for home economics, social studies and biology courses, and a list of useful books and magazines.

♦ "Pointers on Care of Woodwork" is the title of an easy-to-read folder, offered free of charge by Ponderosa Pine Woodwork, 111 West Washington St., Chicago, Ill. This folder was compiled from scores of letters received from leading woodwork manufacturers, dealers, and contractors throughout the country. This association also publishes an interesting 32-page booklet entitled, "The New Open House" which contains many interesting suggestions for remodeling existing houses and rooms.

♦ A new American standard known as Definitions of Electrical Terms, C42, sponsored by the American Institute of Electrical Engineers, is now ready for general distribution.

(Continued on page 43A)

LEATHERCRAFT

Everything in **LEATHER**

A *complete* line of leathers, tools, accessories, patterns, instructions, etc. Guaranteed quality—lowest prices. New white moccasin Kits—ideal for boys and girls.

Write today for free 84-page Catalog No. 1A!

Write for Catalog!

OSBORN BROS., 223 Jackson Blvd., Chicago, U.S.A.

"Westko Modeling Clay"

This clay is used in Schools and Art Institutions throughout the United States.

Write for prices and information

Western Stoneware Co.
Monmouth, Illinois

TOOLS ALWAYS SHARP with PLURALITY OILSTONE TOOL GRINDERS

No. 450 Plurality Jr.

Now available in 3 sizes
No. 425 Plurality Sub Jr.
No. 450 Plurality Jr.
No. 475 Plurality

Grinding can be done on a cone, coarse or fine oilstone, leather stropping or emery wheels. Unit is compact, efficient, serviceable, easily accessible and has ball bearing direct motor drive. Especially guarded for school shop use. Details on request.

Mummert-Dixon Co. Hanover, Pa.
Originators and Pioneer Manufacturers of Oilstone Tool Grinders

PRACTICAL SCHOOL SHOP JOINTER

H and A 6" Jointer, extra long tables, 42" overall, rabbetting type, automatic safety guard adjustable tilting fence, three knife round safety head, ball bearing boxes, made entirely of sand cast iron parts, free of die castings, ½ H.P. single phase motor, 110 volt, starter, bench type as shown.....$102.00
Cast iron floor stand mounted..... 118.00

Send for large circular.

WOODWORKERS' TOOL WORKS
224 S. Jefferson Street Chicago, Illinois

(Continued from page 38A)

This glossary is the result of more than 12 years' work of a sectional committee of 46 members having 18 subcommittees drawn from available specialists. More than 300 individuals have given material assistance and many others have assisted in specific instances. The 34 organizations represented on this sectional committee include the national engineering, scientific and professional societies, trade associations, government departments and miscellaneous groups. The book sells at $1.

"THE INSIDE OF ARC WELDING"

To speed up the training of thousands of arc-welding operators needed for the fabrication of ships, tanks, aircraft, and other war equipment, the General Electric Co., Schenectady, N. Y., have prepared a new six-part, all-color, sound movie entitled "The Inside of Arc Welding." The first part of the movie, complete in itself, is now available to public, private, and industrial welding schools, and other groups, while the other five parts will be ready early in June.

Explained, and emphasized throughout the six parts are the four principal factors of good welding: (1) current setting; (2) angle of electrode; (3) arc length; and (4) speed of travel.

Part 1 is on Fundamentals. The welds demonstrated in this reel are beads on flat plate. Part 2, Flat Position, and Part 3, Horizontal Position, demonstrate fillet and groove welds. Part 4, Alternating Current—Flat and Horizontal Positions, demonstrates how larger electrodes speed up welding. Part 5, Vertical Position, and Part 6, Overhead Position, also use fillet and groove welds.

The films may be obtained for single showings, or bought at print cost, by writing General Electric's Visual Instruction Section, Schenectady, N. Y., or the nearest G-E. office or welding distributor.

Shop Equipment News

(Continued from page 37A)

McKenna Metals Co., 305 Lloyd Ave., Latrobe, Pa.

For brief reference use IAVE—911
For brief reference use IAVE—912

RADIAL DRILL PRESS

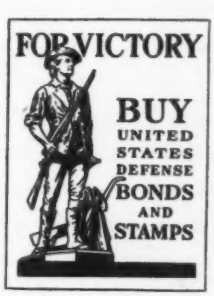
R.D. 1170 and R.D. 1175J are two new radial drill presses designed to meet today's industrial demands. Model R.D. 1170 is equipped with an end mounted motor, belted directly to the drill-press spindle. Standard 1740 r.p.m. motors provide four speeds from 600 to 5000 r.p.m. Motors are also available with a two-speed (1740–3450 r.p.m.) winding (for 3 phase only) which doubles the speed range.

R.D. 1175J incorporates a built-in bearing shaft which greatly widens the speed range and is also equipped with a ball thrust bearing on the collar support.

Both models have the titling head features.

Walker Turner Co. Inc., Plainfield, N. J.

For brief reference use IAVE—913



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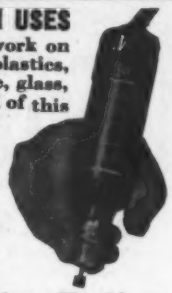
TOOL OF 1001 USES

Does precision work on metals, alloys, plastics, wood, horn, bone, glass, etc. Original tool of this type and the favorite today.



A WHOLE TOOLSHOP IN ONE HAND

Uses 300 accessories to grind, drill, polish, rout, cut, carve, sand, saw, sharpen, engrave. Plugs in any socket. Wt. 12 oz. 25,000 r.p.m. *$18.50* postpaid with 7 Accessories.

EVERY VOCATIONAL SCHOOL NEEDS THIS ULTRA DE LUXE SET

Strong, metal carrying case contains a DeLuxe model Handee and 45 of the most popular and most practical accessories. It's a good idea to begin with this set and then add accessories as needed.

Postpaid, *$25.00.*

ORDER on 10-DAYS MONEY-BACK TRIAL

FREE—64-page Catalog describes all Handee Products and their wide application in crafts and industry all over the world.

CHICAGO WHEEL & MFG. CO.
1101 W. Monroe Street Dept. IA Chicago, Illinois

. SILK SCREEN PROCESS .

Today's modern method for economically reproducing all manner of posters, signs, lettering, and displays in colors. For full particulars, write . . .

SILK SCREEN SUPPLIES, Inc.
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MACHINISTS
AND TOOL MAKERS HANDY BOOK

JUST OUT! 4

1600 PAGES FULLY ILLUSTRATED

ASK TO SEE IT

A READY REFERENCE
Tells How to Operate and Set Up Lathes, Screw and Milling Machines, Shapers, Drill Presses and All Other Machine Tools.

A KEY TO SHOP PRACTICE
In All Branches. For Every Machinist, Toolmaker, Machine Operator, Draughtsman, Metal Worker, Mechanic and Student.

5 PRACTICAL BOOKS IN ONE! GO FULLY ILLUSTRATED CHAPTERS
Covering 1—Modern Machine Shop Practice. 2—Blue Print Reading and How to Draw. 3—Calculations & Mathematics for Machinists. 4—Shop Physics. 5—How to Use the Slide Rule.

$4 Get this information for yourself. Mail coupon today. No obligation unless satisfied.
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Mail AUDELS MACHINISTS & TOOLMAKERS HANDY BOOK, Price $4 on 7 Days Free Trial. If O. K. I will remit $1 in 7 days and $1 monthly until $4 is paid. Otherwise I will return it.

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Address_____
Occupation_____
Reference_____

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We have made a specialty of serving schools with their lumber needs for more than 50 years. This experience is your assurance that you will get quality lumber at the right price. Tegge lumber can be used immediately upon delivery because sixty-five per cent of our lumber stock is under shed.

Write for quotations on your next year's requirements.

THE TEGGE LUMBER CO.

1500 W. Bruce Street Milwaukee, Wis.

Announcing

The acquisition of *Fanwood Specialties Co., Plainfield, New Jersey* by the *Craftsman Supply House.*

The combining of the stock of these two leaders in the *Plastic* field assures you an ample supply of *Plastics* for the coming school year.

Customers of Fanwood Specialties Co. may use the Fanwood Manual in placing orders. We are fully prepared to serve you and will give the same fine service extended by Fanwood Co. *Fanwood Manuals* may be had by writing on your school stationery.

CRAFTSMAN SUPPLY HOUSE

SCOTTSVILLE, NEW YORK

BALDOR

ELECTRICAL SPECIALISTS for 22 YEARS

Manufacturers of

ELECTRIC MOTORS
ELECTRIC MOTOR GRINDERS
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FAST BATTERY CHARGERS
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Write for Bulletins

BALDOR ELECTRIC COMPANY
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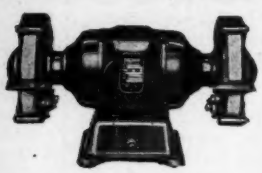

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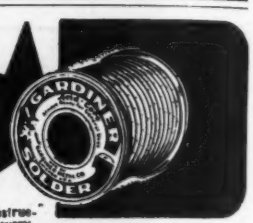

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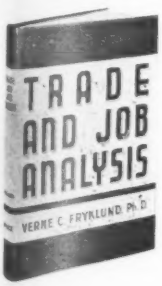

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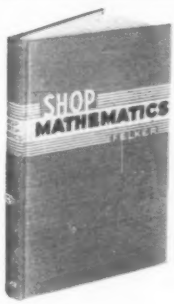

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